THE

Tea Research Institute

OF

Ceylon

BULLETIN No. 37

Annual Report for the Year 1955

Published by
THE TEA RESEARCH INSTITUTE OF CEYLON
ST. COOMBS, TALAWAKELLE, CEYLON.
1956.

COMMONWEALTH MYCOLOGICAL INSTITUTE
10 APR 1957

The Tea Research Institute of Ceylon

Staff at December, 31st 1955

Director	...	G. B. Portsmouth, B.Sc. (Lond.), A.R.C.S., D.I.C.
Technical Assistant to the Director	...	J. V. Harbord, M.A. (Cantab.), A.I.C.T.A.
Chemistry		
Agricultural Chemist	...	J. A. H. Tolhurst, B.Sc. (Reading)
Research Assistant, Biochemistry.	...	M. S. Ramaswamy, B.Sc. (Mysore), A.R.I.C., A.I.I.Sc.
Research Assistant to the Agricultural Chemist	...	E. N. Perera
Assistant	...	V. Mendis
Technology		
Technologist	...	E. L. Keegel
Assistant	...	S. M. Gunaratnam
Plant Physiology		
Plant Physiologist	...	Vacant
Research Assistant to the Plant Physiologist		F. H. Kehl
Assistants	...	M. Piyasena, L. M. de W. Tillekeratne, B.Sc. (Cey.), A. C. B. Pethiyagoda, D. D. Kroon, D. H. de Saram, H. B. Ratnayake, J. I. H. Bandaranayake.
Pathology		
Pathologist	...	C. A. Loos, F.L.S., M.I.Biol.
Mycologist	...	B. N. Webster, M.A. (Cantab.), M.Sc. (Nottm.), M.I.Biol.
Entomologist	...	B. A. Baptist, B.Sc. (Lond.), Ph.D. (Cantab.).
Entomologist, Special Research	...	E. Judenko, Ph.D. (Cracow).
Assistant Entomologist	...	G. D. Austin
Assistants	...	D. J. W. Ranaweera, M. K. Vythilingam, J. V. Sabanayagam, C. Shanmugan, S. Murugiah and G. B. Rajapakse.
Engineering		
Maintenance Engineer	...	D. V. W. Perera, A.M.I.B.E.
Works Clerk	...	R. A. Daniel
Electrician	...	W. R. Solomon
Mechanics	...	D. A. S. Opatha and K. S. Vadivelu
St. Coombs Estate		
Superintendent	...	E. S. Rose
Tea Maker	...	A. T. Fernando
Dispenser	...	S. P. de Silva
Office Assistants	...	P. E. de Silva and G. L. A. Thomas
Low-Country Sub-Station		
Scientific Officer	...	T. E. Walter, B.Sc., (Edin.)
Assistant	...	F. P. Jayawardena
Administration		
Secretary	...	G. A. D. Kehl
Secretary to the Director		A. C. Perera
Assistant Secretary	...	C. Kirthiratne, A.C.C.S. (Lond.), F.R.Econ.S.
Accounts Clerk	...	A. H. B. Dias
Office Assistants	...	F. G. de Sielvie, D. C. W. T. Amarasingha, F. N. C. de Silva, R. I. Pereira, and W. P. Chandrasekera.

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CONTENTS

	Page
30th Annual Report of the Board of the Tea Research Institute of Ceylon for the year 1955	5
Audited Statement of Accounts and Balance Sheet for the year 1955	13
Report on St. Coombs Estate for the year 1955	17
Meteorological Observations, St. Coombs, for the year 1955 ...	23
Report of the Director for the year 1955	24
Report of the Agricultural Chemist for the year 1955	26
Report of the Technologist for the year 1955	33
Report of the Plant Physiology Department for the year 1955 ...	40
Report of the Pathologist for the year 1955	51
Report of the Mycologist for the year 1955	53
Report of the Entomologist for the year 1955	58
Report of the Scientific Officer, Low-Country Sub-Station, for the year 1955	60
Report of the Maintenance Engineer for the year 1955	65
Report of the Officer-in-Charge, Small Holdings Advisory Service, for the year 1955	68

THIRTIETH ANNUAL REPORT OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON FOR THE YEAR 1955

Foundation.—The Tea Research Institute of Ceylon was established by Ordinance No. 12 of 1925 dated 27th October, 1925.

The personnel constituting the Board of Control is laid down in the above Ordinance and in the following Tea Research (Amendment) Acts.

No. 24 of 1948 dated 20th December, 1948
No. 51 of 1953 „ 19th „ 1953
No. 20 of 1955 „ 14th April, 1955

The members of the Board on 1st January, 1955, were:—

Ex-Officio Members

The Director of Agriculture (Dr. A. W. R. Joachim, O.B.E.).

The Hon'ble the Minister of Finance (represented by Mr. W. D. Gunaratna, O.B.E., Controller of Finance, General Treasury).

The Chairman, Planters' Association of Ceylon (Mr. K. Morford, C.B.E.).

The Chairman, Agency Section, Planters' Association of Ceylon, Mr. D. F. Ewen, C.B.E.).

The Tea Controller (Mr. D. C. L. Amarasinghe, C.C.S.).

Representatives of the Planters' Association of Ceylon.

Mr. H. S. Hurst.
Mr. R. C. Scott, C.B.E.
Mr. N. B. Parker.

Representatives of the Planters' Association of Ceylon, Agency Section.

Mr. A. D. McLeod, (on leave, Mr. W. H. Gourlay acting).
Mr. G. K. Newton.
Mr. C. D. Green.

Representatives of the Low-country Products Association.

Mr. J. L. D. Pieris.
Mr. B. Amarasuriya.
Mr. F. Amarasuriya.

Representative of the Smallholders

Mr. V. G. W. Ratnayaka, M.B.E., M.P.

Chairman:	Mr. H. S. Hurst.
Secretary:	Mr. J. Lamb, O.B.E.
Solicitors:	Messrs. Julius & Creasy.
Auditors:	Messrs. Ford, Rhodes, Thornton & Co.
Registered Office:	St. Coombs, Talawakelle.

The following changes in the personnel of the Board were recorded during the year:—

Ex-Officio Members.—Mr. R. H. Wickramasinghe, M.B.E., Acting Deputy Secretary to the Treasury, vice Mr. W. D. Gunaratna, O.B.E., as from 7th February.

Mr. K. G. Sinclair, Chairman, Planters' Association of Ceylon, vice Mr. K. Morford, C.B.E., as from 25th March.

Mr. C. F. H. Edwards, Chairman, Planters' Association of Ceylon, Agency Section, vice Mr. D. F. Ewen, C.B.E., as from 25th March.

By the Tea Research (Amendment) Act No. 20 of 1955, the Chairman of the Low-country Products Association was appointed an ex-officio member of the Board. Senator E. W. Kannangara, C.B.E., therefore, assumed this seat as from 14th April, the Date of Assent of the Act.

Mr. A. D. McLeod, Chairman, Planters' Association of Ceylon, Agency Section, vice Mr. C. F. H. Edwards as from 12th September.

Dr. W. R. C. Paul, Acting Director of Agriculture, acted for Dr. A. W. R. Joachim, O.B.E. as from 1st October.

Representatives of the Planters' Association of Ceylon.—Mr. H. Stacey Hawkes acted for Mr. R. C. Scott, C.B.E., and Mr. A. R. Cathcart for Mr. N. B. Parker, both from 5th April. Mr. Scott and Mr. Parker resumed their seats on the Board in December.

Mr. H. S. Hurst resigned his seat on the Board on 2nd December.

The Board paid tribute to Mr. Hurst's services to the Institute as a Board member during a long period, in the last year of which he occupied the position of Chairman.

Mr. K. G. Sinclair was unanimously elected to succeed him.

Representatives of the Planters' Association of Ceylon, Agency Section.—Mr. A. D. McLeod returned from leave and resumed his seat on the Board vice Mr. W. H. Gourlay as from 1st February.

Mr. G. K. Newton was renominated for a further term of three years as from 22nd February.

Mr. G. J. Harris acted for Mr. C. D. Green (on leave) from 20th June until 16th November. On returning from leave Mr. Green resigned his seat and Mr. Harris was nominated to succeed him as from 16th November.

Mr. R. M. Macintyre was nominated to succeed Mr. A. D. McLeod as from 17th October.

Representatives of the Smallholders.—By the Tea Research (Amendment) Act No. 20 of 1955, a second representative of the Smallholders was appointed to the Board. Mr. A. Divitotawela was nominated to this seat by the Minister of Agriculture and Food as from 9th June.

Mr. V. G. W. Ratnayaka, M.B.E., M.P. was renominated by the Minister of Agriculture and Food for a further term of three years as from 15th October.

Representative of the House of Representatives.—This seat was also created by the Tea Research (Amendment) Act No. 20 of 1955, and Mr. U. B. Unamboowe, O.B.E., M.P. was nominated by the Minister as from 2nd May.

The Secretary.—Mr. J. Lamb, O.B.E., resigned his position as Director of the Institute and Secretary of the Board and left Ceylon on leave on 17th May. Mr. G. B. Portsmouth was appointed by the Board to succeed him as from this date.

Five meetings of the Board were held, on 21st January, 18th March, 3rd June, 2nd September and 2nd December.

Committees.—*Finance Committee.*—The Chairman, T.R.I. (Mr. H. S. Hurst), The Chairman, Planters' Association of Ceylon, (Mr. K. Morford, C.B.E.), the Chairman, Planters' Association of Ceylon, Agency Section, (Mr. D. F. Ewen, C.B.E.), Mr. A. D. McLeod, (on leave, Mr. G. K. Newton acting), Mr. J. Lamb, O.B.E. (Secretary).

The following changes of membership took place during the year:—

Mr. A. D. McLeod resumed his seat vice Mr. G. K. Newton (acting) as from 1st February.

Mr. J. L. D. Pieris was nominated to the ordinary seat, vacated by Mr. Hurst the previous December, as from 18th March.

Mr. K. G. Sinclair, (Chairman, Planters' Association of Ceylon), vice Mr. K. Morford, C.B.E. as from 25th March.

Mr. C. F. H. Edwards, (Chairman, Planters' Association of Ceylon, Agency Section), vice Mr. D. F. Ewen, C.B.E. as from 25th March.

Mr. G. B. Portsmouth, (Secretary), vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

Mr. R. H. Wickramasinghe, M.B.E., representative of the Minister of Finance, was nominated to the Committee as from 2nd September.

Mr. A. D. McLeod, (Chairman, Planters' Association of Ceylon, Agency Section), vice Mr. C. F. H. Edwards as from 12th September.

Mr. R. M. Macintyre vice Mr. A. D. McLeod as from 2nd December.

Mr. H. S. Hurst resigned his seat on 2nd December and was succeeded as Chairman by Mr. K. G. Sinclair.

Two meetings were held during the year, on 2nd September and 1st December.

Standing Committee.—Mr. H. S. Hurst, (Chairman), Messrs. D. F. Ewen, C.B.E., D. C. L. Amarasinghe, C.C.S., A. D. McLeod (on leave, Mr. W. H. Gourlay acting), F. Amarasuriya and J. Lamb, O.B.E. (Secretary).

The following changes occurred during the year:—

Mr. A. D. McLeod resumed his seat vice Mr. W. H. Gourlay as from 1st February.

Mr. C. F. H. Edwards vice Mr. D. F. Ewen, C.B.E. as from 25th March.

Mr. G. B. Portsmouth, (Secretary), vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

Mr. K. G. Sinclair vice Mr. C. F. H. Edwards as from 2nd December.

Mr. H. S. Hurst resigned his seat on 2nd December.

Five meetings were held during the year, on 18th February, 16th May, 5th August, 4th November and 21st December.

Experimental and Estate Committee.—Chairman, the Director, T.R.I., (Mr. J. Lamb, O.B.E.), Mr. H. S. Hurst, (Chairman, T.R.I.), Mr. G. K. Newton, (Visiting Agent, St. Coombs Estate), Mr. E. S. Rose, (Superintendent, St. Coombs Estate), Messrs. R. C. Scott, C.B.E., T. Kane, S. P. Vytilingam, M.P., D. E. Hettiarachchi, J.P., U.M., R. J. S. Bean, and the Senior Staff, T.R.I. with Mr. B. N. Webster as Convener.

Following the acceptance by the Board in December 1954 of the recommendations of the sub-committee appointed by the Experimental and Estate Committee, this latter was increased by the addition of two nominated members and one ex-officio member, the Chairman of the Planters' Association of Ceylon, early in 1955. The new Committee is composed as follows:—

Ex-Officio members.—The Director, T.R.I., (Chairman), the Chairman, T.R.I., The Visiting Agent, St. Coombs; The Superintendent, St. Coombs; The Chairman, Planters' Association of Ceylon, and the Senior Staff, T.R.I.

Nominated members.—One for manufacture and tasting, one for Deniyaya and Southern Province, one for Kalutara and Kelani Valley, one for Sabaragamuwa, one for Kandy, Matale and Pussellawa, one for Dimbula, one for Dickoya and Maskeliya, one for Nuwara Eliya, one for Uva, (Haputale side) and one for Uva (Passara side).

The following changes in personnel were recorded during the year:—

Mr. K. Morford, C.B.E., (Chairman, Planters' Association of Ceylon), as from 18th March.

Mr. R. C. P. Adams was nominated as representative for Nuwara Eliya as from 18th March.

Mr. J. E. Davidson was nominated as representative for the Haputale side of Uva as from 18th March.

Mr. R. L. Harvey was nominated as representative for the Passara side of Uva as from 18th March.

Mr. A. Watt was nominated as representative for Sabaragamuwa as from 18th March.

Mr. K. G. Sinclair, (Chairman, Planters' Association of Ceylon), vice Mr. K. Morford, C.B.E. as from 25th March.

Mr. K. Morford, C.B.E. was nominated as representative for Dimbula as from 25th March.

Mr. N. M. Sanders (acting) vice Mr. R. C. P. Adams (on leave) from 25th March to 25th September.

Mr. R. C. Scott, C.B.E. was on leave from 5th April. Mr. K. G. Sinclair represented Dickoya-Maskeliya in his absence.

Mr. G. B. Portsmouth, (Director, T.R.I.), took over as Chairman vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

Mr. Gorton Coombe (acting) vice Mr. J. E. Davidson (on leave) as from 14th August.

Mr. J. V. Harbord (Convener) vice Mr. B. N. Webster as from 1st October.

Mr. A. J. Pelly Fry (acting) vice Mr. T. Kane (on leave) as from 10th October.

Mr. H. S. Hurst resigned his seat as from 2nd December, and was succeeded by Mr. K. G. Sinclair.

The Committee met four times, on 5th February, 7th May, 6th August and 5th November.

Low-country Committee.—Mr. J. L. D. Peiris, Mr. R. J. S. Bean (co-opted), Mr. J. Lamb, O.B.E. (Director, T.R.I.).

The following changes occurred during the year:—

Mr. F. Amarasuriya was nominated to fill the seat vacated by Mr. D. E. Hettiarachchi the previous December as from 21st January.

Mr. G. B. Portsmouth, (Director, T.R.I.), vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

No meeting was held during the year.

Smallholdings Committee.—Mr. V. G. W. Ratnayaka, M.B.E., M.P. (Chairman), Mr. D. C. L. Amarasinghe, C.C.S., Mr. F. Amarasuriya, Mr. J. Lamb, O.B.E., (Director, T.R.I.), Mr. R. L. Illankoon, (Officer-in-charge, Smallholdings Advisory Service), Convener.

Changes in personnel during the year were:

Mr. G. B. Portsmouth, (Director, T.R.I.), vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

Following his nomination to the Board to represent the Smallholders, Mr. Divitotawela assumed a seat on the Committee as from 1st December.

Three meetings of the Committee were held on 2nd June, 1st September and 1st December.

Appointments Committee.—The Chairman of the Board, (Mr. H. S. Hurst), The Director of Agriculture, (Dr. A. W. R. Joachim, O.B.E.), a further Board Member nominated by the Chairman, The Director, T.R.I. (Mr. J. Lamb, O.B.E.).

During the year the following changes occurred:—

Mr. J. L. D. Pieris was nominated to the seat previously vacated in 1954 by Sir Ivor Jennings, Q.C., as from 18th March.

Mr. G. B. Portsmouth, (Director, T.R.I.), vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

Mr. K. G. Sinclair, (Chairman, T.R.I.), vice Mr. H. S. Hurst (resigned) as from 2nd December.

The Committee mêt once, on 21st December.

Trustees—T.R.I. Junior Staff Provident Fund.—The Chairman, T.R.I., (Mr. H. S. Hurst), the Director, T.R.I., (Mr. J. Lamb, O.B.E.), Mr. V. G. W. Ratnayaka, M.B.E., M.P., Mr. E. N. Perera representing the Junior Staff, Mr. A. D. McLeod (nominated), (on leave, Mr. W. H. Gourlay acting).

Personnel changes were as follows:—

Mr. A. D. McLeod resumed his seat vice Mr. W. H. Gourlay (acting) as from 1st February.

Mr. G. B. Portsmouth, (Director, T.R.I.), vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

Mr. K. G. Sinclair, (Chairman, T.R.I.), vice Mr. H. S. Hurst (resigned) as from 2nd December.

One meeting was held during the year, on 2nd September.

Committee of Management, Junior Staff Medical Fund.—The Chairman, T.R.I., (Mr. H. S. Hurst), the Director, T.R.I., (Mr. J. Lamb, O.B.E.), Mr. G. D. Austin representing the Junior Staff.

During the year there were the following changes:—

Mr. G. B. Portsmouth, (Director, T.R.I.), vice Mr. J. Lamb, O.B.E. (resigned) as from 17th May.

Mr. K. G. Sinclair, (Chairman, T.R.I.), vice Mr. H. S. Hurst (resigned) as from 2nd December.

The Committee met once, on 2nd September.

Visiting Agent.—Mr. G. K. Newton continued as Visiting Agent for St. Coombs Estate. He paid three visits during the year, on 12th April, 5th/6th August, and 15th December.

Finance.—Total income for the year amounted to Rs. 2,331,668 as compared to Rs. 2,387,821 in 1954. The shortfall of Rs. 56,153 was accounted for by decreases in takings from cess collections (Rs. 1,990,503) and profit from St. Coombs Estate (Rs. 308,474). There was however an increase in the income derived from other sources, chiefly from profit from sale of fixed assets (Rs. 17,869) and interest (Rs. 12,639).

Total revenue expenditure amounted to Rs. 1,448,012, an increase of Rs. 169,159 over that for 1954. This was mainly due to greatly increased expenditure on the maintenance of buildings and their surrounds, on roads, and on new items such as V.P. expansion, and experiments on Mooloya and Endane estates.

Capital expenditure for the year amounted to Rs. 275,962 and comprised Land Development Rs. 34,760, Buildings Rs. 33,376, Furniture Rs. 76,582, Equipment Rs. 31,136, Vehicles Rs. 83,742 and Machinery Rs. 16,364.

Net Liquid Assets at 31st December, 1955, after allowing for liabilities on Furlough Pay and Passages, (Rs. 108,840) Small Holdings Advisory Service, (Rs. 194,966) Sundry Creditors, (Rs. 105,696) amounted to Rs. 2,006,031. It must however be pointed out that work on the extensive development programme has yet to start.

The total accumulated in the Depreciation Provision a/c as at 31st December, 1955 was Rs. 1,116,085.

Small Holdings Advisory Service.—Income for the year was Rs. 317,423, made up of the annual grant from the T.R.I. of Rs. 300,000, interest Rs. 9,853, and profit on sale of manure, tea seed, etc. Rs. 7,570.

Revenue expenditure excluding depreciation amounted to Rs. 194,958, of which Rs. 135,136 was on emoluments of staff.

There was therefore a saving of Rs. 122,465.

Capital expenditure, which included the cost of photographic equipment, (Rs. 6,521) amounted to Rs. 9,862.

Net Liquid Assets of the Service as at 31st December, 1955 amounted to Rs. 393,782, of which Rs. 165,575 was invested in Ceylon Government Loan stock.

St. Coombs Estate.—The working account for the year showed a profit of Rs. 308,474, a decrease of Rs. 66,904 on the previous year. The crop harvested was 298,763 lbs. giving a yield per acre of 1,104 lbs., both record figures for St. Coombs. There was however a slight drop in the prices realised for St. Coombs teas. The net sale average for 1955 was Rs. 2.71 as compared with Rs. 2.89 for 1954.

Publications.—Four parts of the 'Tea Quarterly' Vol. XXVI, and Bulletin No. 36, the Annual Report for 1954, were published. The total

amount collected by way of subscriptions and sundry sales (Rs. 3,897) and advertisements (Rs. 5,530) amounted to Rs. 9,427. Cost of printing and distribution amounted to Rs. 22,229 which meant that the cost to the Institute was Rs. 12,802.

Acknowledgments.—As in the past the Institute continued to receive the fullest co-operation from the Ceylon Association in London, The Planters' Association of Ceylon, The Agency Section of the Planters' Association of Ceylon, Agency Houses, Engineering Firms and other bodies concerned with the tea industry in Ceylon; to all of whom the Board is deeply grateful.

Particular mention must be made of the Planters' Association of Ceylon for having placed their meeting room at the disposal of the Board for meetings of the Board and its various Committees.

Accounts.—Messrs. Ford, Rhodes, Thornton and Company remained the Institute's auditors. The audited Statement of Accounts and the Balance Sheet for the year ended 31st December, 1955, follow this report, together with the reports of the Director and the Scientific and other staff.

G. B. PORTSMOUTH,
Secretary.

Tea Research Institute of Ceylon,
St. Coombs,
Talawakelle.
19th July, 1956.

THE TEA RESEARCH INSTITUTE OF CEYLON.

BALANCE SHEET AS AT 31st DECEMBER, 1955

1954 Rs.		Rs. Cts.	Rs. Cts.	1954 Rs.				Rs. Cts.	Rs. Cts.
	ACCUMULATED FUND:—						**FIXED ASSETS**		
	Expended on fixed assets		3,849,636.34		3,293,383		Cost	Rs. 3,597,046.30	
					314,074		Additions—1955	„ 275,962.38	
	Unexpended Fund—				3,607,457			Rs. 3,873,008.68	
	Balance as at 1st January, 1955	3,972,053.85					*Less:* Sales and scrapped in 1955		
	Add: Excess of income over expenditure for 1955 ...	767,528.51		3,597,047	10,410		at cost	Rs. 23,372.34	3,849,636.34
		4,739,582.36					*Less:* Depreciation Provision—		
	Less: Expended on fixed assets up to 31st December, 1955	3,849,636.34	889,946.02		943,461		As at 31st December, 1954 ...	Rs. 1,030,579.59	
3,972,054			4,739,582.36		94,914		Depreciation—1955 ...	„ 116,128.10	
					1,038,375			Rs. 1,146,707.69	
	CURRENT LIABILITIES:—			1,030,580	7,795		*Less:* Depreciation on items scrapped or sold, and profit on sales	Rs. 30,622.91	1,116,084.78
				2,566,467					2,733,551.56
	CREDITORS AND PROVISIONS:—						**INVESTMENTS AT COST:—**		
121,298	Creditors	105,696.20					Ceylon Government securities		237,075.00
129,163	Provision for Furlough Pay and Passage	108,840.38		299,438			United Kingdom Government securities		62,362.82
75,426	Small Holdings Advisory Service	194,965.60	409,502.18				(Approximate market value Rs. 293,100/-) ...		299,437.82
							CURRENT ASSETS:		
				143,208			Debtors—General		188,599.57
				28,909			Debtors and other debit balances—Research ...		51,466.98
				—			Deferred expenditure		16,654.66
							Stocks—		
							Tea at prices since sold ...	Rs. 101,170.47	
				129,909			Other stocks	„ 42,419.16	143,589.63
				1,130,010			Cash in hand and at banks—		1,715,784.32
									2,116,095.16
4,297,941		Rs.	5,149,084.54	4,297,941					Rs. 5,149,084.54

We have examined the above balance sheet with the books of the Tea Research Institute of Ceylon and St. Coombs Estate and have obtained all the information and explanations we have required. In our opinion the foregoing balance sheet is properly drawn up so as to exhibit a true and correct view of the financial affairs of the Institute as at 31st December, 1955, according to the best of our information and the explanations given to us and as shown by the books.

(Signed) FORD, RHODES, THORNTON & Co.,
Chartered Accountants.

Colombo, 6th July, 1956.

THE TEA RESEARCH INSTITUTE OF CEYLON.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1955

1954 Rs.		Rs. Cts.	1954 Rs.		Rs. Cts.
89,310	Administration of the Board		375,378	Balance from Estate Working Account	308,474.31
231,036	Senior scientific staff	105,998.45	2,001,417	Tea cess	1,990,503.63
120,538	Junior and sub-scientific staff	259,870.26	8,810	Interest	12,638.56
21,743	Laboratory	129,064.59	1,800	Rent of cadday	1,800.00
14,255	Library and publications	27,181.49	139	Miscellaneous receipts	382.32
250,000	Small Holdings Advisory Service	21,218.78	—	Profit on Austin tipper working	17,869.38
43,752	Field and factory experiments	300,000.00	—	Profit on sales of Fixed Assets	
35,462	Travelling of staff	60,743.38			
33,419	Maintenance of buildings	53,787.40			
70,698	General services	13,359.05			
135,262	Miscellaneous	128,075.97			
46,003	Workshop	146,466.00			
16,212	Low Country sub-station	43,014.43			
94,914	Depreciation	17,919.20			
—	Board of Survey—buildings	116,128.10			
—	Endane experiments	81,868.65			
—	Mooloya experiments	17,801.72			
—	V.P. expansion	15,861.38			
—	Loss on working stone crusher	10,107.80			
—	Factory	5,841.45			
1,184,940	Balance being excess of income over revenue expenditure for the year ended 31st December, 1955	9,831.59			
		767,528.51			
2,387,544		Rs. 2,331,668.20	2,387,544		Rs. 2,331,668.20

THE TEA RESEARCH INSTITUTE OF CEYLON.

SUMMARY OF FIXED ASSETS AND VEHICLES — 31st DECEMBER, 1955.

	ASSET ACCOUNT				DEPRECIATION ACCOUNT					
	Cost at 31-12-54	Additions 1955	Deduct sales written off at cost	Cost at 31-12-55	Accumulated to 31-12-54	Depreciation 1955	Depreciation on assets sold or scrapped	Accumulated to 31-12-55	Profit on sales	Written down value 31-12-55
	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.
Land including development ...	1,065,990.52	34,760.11	—	1,100,750.63	66,123.67	3,860.63	—	69,984.30	—	1,030,766.33
Buildings and lines ...	1,819,998.53	33,377.04	—	1,853,375.57	641,640.63	53,029.49	—	694,670.12	—	1,158,705.45
Furniture and equipment ...	260,384.13	8,409.74	1,218.81	267,575.06	45,522.71	16,080.81	—	61,603.52	—	205,971.54
—do— Board of Survey ...	—	66,874.06	—	66,874.06	—	—	—	—	—	66,874.06
Laboratory equipment ...	89,335.95	16,878.86	—	106,214.81	57,151.12	4,719.94	—	61,871.06	—	44,343.75
Experimental machinery ...	68,914.02	630.90	—	69,544.92	32,925.44	6,891.40	—	39,816.84	—	29,728.08
Estate machinery ...	156,492.47	—	—	156,492.47	142,690.69	13,801.78	—	156,492.47	—	—
Workshop machinery ...	25,006.67	—	—	25,006.67	2,500.66	2,500.66	—	5,001.32	—	20,005.35
—do— equipment ...	12,022.27	668.20	—	12,690.47	1,082.47	1,202.22	—	2,284.69	—	10,405.78
—do— furniture ...	1,796.75	—	—	1,796.75	—	—	—	—	—	1,796.75
Library shelving ...	1,093.37	1,298.41	—	2,391.78	—	—	—	—	—	2,391.78
Institute vehicles ...	31,293.53	65,018.05	18,886.03	77,425.55	21,987.91	3,101.88	18,886.03	6,203.76	6,100.00	71,221.79
Workshop vehicles ...	27,727.93	18,723.75	3,267.50	43,184.18	4,433.36	6,931.99	1,633.76	9,731.59	1,666.26	33,452.59
Spectrophotometer ...	—	13,589.46	—	13,589.46	—	—	—	—	—	13,589.46
Leaf hoist ...	2,055.38	—	—	2,055.38	1,027.65	513.85	—	1,541.50	—	513.88
Lawn mowers ...	767.78	—	—	767.78	325.00	76.77	—	401.77	—	366.01
Monkey grubber ...	2,534.77	—	—	2,534.77	1,013.88	253.47	—	1,267.35	—	1,267.42
Dusters, sprayers and pumps ...	20,923.68	—	—	20,923.68	2,051.28	2,092.36	—	4,143.64	—	16,780.04
Leaf elevator ...	10,708.55	—	—	10,708.55	—	1,070.85	—	1,070.85	—	9,637.70
Winget stone crusher ...	—	15,733.80	—	15,733.80	—	—	—	—	—	15,733.80
Rs.	3,597,046.30	275,962.38	23,372.34	3,849,636.34	1,020,476.47	116,128.10	20,519.79	1,116,084.78	7,766.26	2,733,551.56
Add: Nett profit on sales in previous years ...	...	...	...	...	10,103.12	10,103.12	—	10,103.12		
Profit on sales this year (1955) ...	...	...	...	...	7,766.26	—	7,766.26	—	—	
					17,869.38	1,030,579.59	123,894.36	30,622.91	1,116,084.78	

THE TEA RESEARCH INSTITUTE OF CEYLON.

ESTATE WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1955.

1954 Rs.			Rs. Cts.	Rs. Cts.	1954 Rs.				Rs. Cts.	Rs. Cts.
		ESTATE EXPENDITURE—REVENUE:—					TEA SALES—GROSS PROCEEDS:—			
	98,362	General charges	121,299.69			809,487	Colombo 286,834 lbs.	787,736.33		
	77,362	Upkeep	80,743.22			2,887	Local 2,032 ,, ...	4,066.73		
	50,511	Cultivation	48,974.68			4,204	Broken mixed 7,483 ,, ...	4,286.09		
	109,464	Harvesting	113,830.54			481	Biochemical dept. 172 ,, ...	295.84		
429,972	94,273	Manufacture	99,803.88	464,652.01	817,059	—	Gratis 2,242 ,, ...	— —		796,384.99
							298,763 lbs.			
14,236		Bonus to staff		13,563.81						
10,949		Colombo brokerage and handling charges		10,787.55						
828		Motor cycle		— —	14,304		Profit on sale of Guatemala grass and clonal plants ...			1,092.69
375,378		Balance to Income and Expenditure Account ...		308,474.31						
831,363			Rs.	797,477.68	831,363				Rs.	797,477.68

REPORT ON ST. COOMBS ESTATE FOR THE YEAR 1955

Staff.—In view of the increase in internal transport a temporary driver was taken on from January 1955, as a second tractor driver. All other staff appointments remain the same.

Acreage.—

	A.	R.	P.
In full bearing	267	1	00
New clearing	22	1	17
Green manure clearing	12	0	00
Land fit to open in tea	5	3	00
Buildings and gardens	45	2	11
Fuel clearing	36	3	14
Waste land and ravines	34	0	31
	423	3	33

The acreage statement has altered slightly from 1954 by the increase in new clearing acreage and deduction of acreage of tea in full bearing, following the re-survey of No. 1 field.

Weather.—(Estate gauge)

	Rainfall inches	*Wet days*	*Sunshine hours*
Registered in 1955 ...	90.23	220	1,739
Registered in 1954 ...	83.56	249	1,510
Average (Decennial 1946-1955) ...	90.52	230	1,813

Distribution of rainfall for the year was rather uneven with May and June showing considerable increase over previous records. 22.74″ fell in June, while August recorded 3.69″, which is low for this month. October/November registered below average rainfall, and December was an extremely dry month, with only 1.02″ being recorded.

Sunshine hours show an increase over 1954, but are still below the decennial average.

Crop.—

	1955 *lbs.*	1954 *lbs.*
Estimate	270,000	260,000
Total crop (including off grades) ...	298,763	287,202
Yield per acre on 267¼ acres ...	1,104	—
„ „ „ „ 275¼ acres ...	—	1,043

Crop shows a further increase over previous years, resulting mainly from the continued high standard of plucking, combined with a manurial programme based upon crop intake. The highest yielding field gave 1,417 lbs. per acre between 4 and 12 months from pruning.

Prices and Total Crop Sold.—

Year	*Total crop sold lbs.*	*Total price cents*	*Nett price cents*
1955	286,834	274.63	270.87
1954	276,388	292.88	288.91

Prices realised were high in comparison with the high grown average, and St. Coombs compared favourably with district estates. The type of manufacture remained unchanged throughout the year. Profit for the year was not as high as 1954, but still satisfactory.

Cost of Production.—

	1955 *Cost per lb. (Cts.)*	1954 *Cost per lb. (Cts.)*
Estimate ...	171.92	166.59
Actual ...	155.42	149.08

Profit on Estate Working.—

1955		Rs. 308,474.31
1954	...	Rs. 375,378.44

Capital Expenditure.—

1955	...	Rs. 58,703.82	19.66 cts. per lb.
1954	...	Rs. 69,151.42	24.08 cts. per lb.

The expenditure here was:—

Internal cartroad ...	...	Rs.	455.21
Waterborne sanitation to lines	...	,,	3,068.35
Buildings ...	...	,,	3,810.20
New clearings ...	...	,,	25,276.13
Ravines to be cleared ...	...	,,	5,951.34
Factory ...	...	,,	9,831.59
Morris Minor station wagon	...	,,	9,535.00
Furniture ...	...	,,	776.00

Plucking.—The standard of plucking was generally maintained throughout the year. Rounds continued at 7 and 8 days, except during rush months, when it became necessary to extend them to 9 and 10 days. The individual row system in the new fields continued, *i.e.* in fields up to 2 years from pruning, but it was found necessary to dispense with this method during rush crop seasons.

Estate Roads and Paths.—General upkeep and improvement particularly to the field footpaths were carried on throughout the year.

Fuel Clearings.—Shortage of firewood is still a problem and a system of rationing was introduced. All suitable grass ravines continued to be planted

in gums, in accordance with the long term programme of extending fuel reserves. A small area in the main ravine between 9 and 10 fields was planted up with basket supplies of *Eucalyptus saligna*, obtained from the Government Forest Department, with a view to considering these trees in comparison with red gum as alternative fuel trees.

Ravines and Boundaries.—Routine cleaning of ravines and boundaries continued throughout the year and suitable ravines were completely cleared and the main drains built up in masonry, with a view to supplying in tea. Further work of this nature will be carried out in 1956.

Weeding.—The average cost of weeding was again reduced from Rs. 11/26 per acre per round to Rs. 10/60. Further reduction in cost will be made in 1956, since the weed growth on St. Coombs is now considerably less than in the past.

Pests and Diseases.—Routine control of blister blight, using standard copper fungicides and spray equipment, continued throughout the south west monsoon and into the early part of the north east monsoon. All the pressure retaining knapsacks were fitted with pressure-regulating valves, thereby maintaining more even distribution of the fungicide. Two fields, Nos. 2 and 6, were taken over by the Tea Research Institute for experimental purposes, and blister blight control was carried out under the direct supervision of the T.R.I. staff.

Loranthus creeper, while still in evidence, is gradually coming under control and it is anticipated that the cost of removal will be reduced considerably in subsequent years.

Poria was still of major concern and two rounds of the estate were completed with very careful supervision. All surface trash and root-growth were burnt in an incinerator on the site.

Mite attack, while still in evidence, earlier in the year, soon diminished with the onset of the south west monsoon and there was no recurrence of the pests in large numbers, even under the dry conditions prevailing during the north east monsoon.

Pruning.—A light type of slope prune was carried out according to the programme. The growth of wood was generally good. Nos. 9 and 10 fields, pruned in December, showed remarkable growth and the cut across was modified, so that a certain amount of cleaning up of knotty branches was carried out.

Supplying and Nurseries.—A considerable number of V.P. plants not required for the new clearings was supplied to the cleared ravines in Nos. 6 and 7 fields, and it is expected that there will be quite considerable increases in field acreages with the continuation of the supply work.

No. 2 nursery in No. 12 field, which until recently has been the main source of V.P. supplies for St. Coombs, shows signs of soil deterioration, and it is proposed to discontinue the use of this nursery for tea supplies after the 1956 planting season. The soil will be rejuvenated by growing various types of bush green manures in this area.

Mossing and Ferning.—All fern was removed from pruned fields, mainly by the estate weeding contractors. It has now become routine for these

contractors to remove a considerable amount of fern, month by month, throughout the cycle, and it is satisfactory to note the reduction in the growth of fern generally throughout the estate. All pruned fields were effectively sprayed with lime to control growth of moss.

Working up Poor Areas.—No. 4 field, pruned in the south west monsoon, was subsequently thatched, at the rate of 7 to 8 tons Guatemala grass per acre, according to the existing policy of thatching at least one pruned field annually.

Manuring.—The same system of manuring was continued throughout the year, on the basis of 6 monthly applications, or applications according to the crop intake of each individual field, 500 lbs. per acre from previous manuring application being the datum set.

The following are details of nitrogen and potash applied to individual fields, using T.R.I. 488 mixture:—

Field No.	*Months manured*	1953 *Nit.*	*Pot.*	*Months manured*	1954 *Nit.*	*Pot.*	*Months manured*	1955 *Nit.*	*Pot.*
1	June	59	28	July	46	22	—	—	—
	Dec.	53	25						
2	June	53	25	Sept.	43	20	April	43	20
	Dec.	43	20	Dec.	36	17	Sept.	46	22
3	June	53	25	Sept.	53	25	April	43	20
	Dec.	43	20	Dec.	36	17	Sept.	46	22
4	July	66	31	Jan.	53	25	Feb.	46	22
				Aug.	56	26	Oct.	36	17
5	Nov.	56	26	June	59	28	May	53	25
				Dec.	43	20	Nov.	46	22
6	Feb.	56	26	April	63	30	May	40	19
	Sept.	59	28	Oct.	43	20	Nov.	53	25
7	March	40	19	July	53	25	May	46	22
	Dec.	43	20	Dec.	43	20	Nov.	53	25
8	March	43	20	June	66	31	May	59	28
	Oct.	53	25	Nov.	53	25	Nov.	53	25
9	Feb.	46	22	April	66	31	March	53	25
	Sept.	63	30	Oct.	46	22	Sept.	46	22
10	Jan.	46	22	March	73	34	Jan.	56	26
	Sept.	69	32	Aug.	59	28	May	46	22
							Oct.	46	22
11	Feb.	63	30	April	69	32	May	40	19
	Sept.	69	32	Dec.	53	25	Oct.	53	25
12	March	56	26	May	43	20	May	63	30
	Oct.	56	26	Nov.	53	25	Oct.	46	22
13	March	28	15	May	69	32	April	56	26
	Oct.	40	19	Nov.	59	28	Sept.	46	22
14A	July	66	31	Jan.	63	30	Jan.	56	26
							July	56	26
							Dec.	56	26
14B	July	73	34	Jan.	53	25	Jan.	56	26
				June	66	31	July	56	26
							Dec.	59	28

Green Manure and Shade Trees.—*Grevillea, Albizzia sumatrana, Albizzia moluccana* and dadaps, were planted up in the pruned fields and resupplied to the young fields according to the long term green manure and shade tree programme.

The greenhouse is now being used solely for the rearing of *Albizzia sumatrana* and *Grevillea* plants and there is no doubt that this has proved to be a great success.

Replanting of Old Tea.—General upkeep continued throughout the year in No. 10 new clearing. The 1952 planted area, brought into full bearing, was plucked by estate labour, with the yields of individual clonal blocks kept separately. The 2024 block in this area gave a higher yield per acre than the yield calculated from the T.R.I. clonal test rows during the same per od from planting.

The uprooting of tea in No. 1 field commenced in January 1955, with the arrival of the Hesford Hercules winch, and continued throughout the year, leaving a small balance to be completed in 1956. The whole of the area was thrown out of bearing early in the year, and no crop was harvested.

The 8 acres planted since the beginning of this clearing, have proved to be most unsatisfactory, with the percentage of success as low as 50 per cent. The main factors bringing about this extremely high loss were dry weather soon after planting, and soil conditions, which made the area unsuitable for tea supplies not in baskets. It has been decided, therefore, that in 1956 large areas in No. 1 will be completely resupplied with alternate clones, all plants to be basket plants. The area planted in clone 2025 has, however, come away well, with a very low percentage of losses, and it is considered that aspect combined with time of planting are the main reasons for the success of this block. The work undertaken in this field has been mainly of an experimental nature, and has proved conclusively that new clearing planting techniques must be modified according to terrain, aspect, weather conditions, and soil types, and the major reason for the success achieved in No. 10 in comparison with the No. 1 new clearing is obviously the difference in soil type.

Factory and Machinery.—Considerable improvements were made to the factory during the year. All the ground floor walls, machinery and equipment were painted in accordance with colour plans provided by Messrs. Imperial Chemical Industries (Export) Limited. Coloured eternite sheeting has been used for covering the tops of many of the tables, with a view to improving factory hygiene.

New types of white plastic bowls produced by Messrs. Imperial Chemical Industries (Export) Limited are now being used in the rolling and sifting rooms. These, while expensive, are a great improvement on existing types in common use.

A leaf hoist was erected earlier in the year and the outside steps were subsequently removed. The hoist did not prove to be entirely satisfactory, in its original form, for the transportation to the lofts of the square transport baskets in use on St. Coombs, but Messrs. Walker and Greig Ltd. have carried out some major modifications and by the end of the year the hoist was working most satisfactorily.

Messrs. Shell Company of Ceylon, Limited have laid two squares of coloured flintkote flooring, green in the rolling room and red in the drying

room, which are being tested for their ability to withstand the wear and tear of normal factory work.

All the factory machinery was carefully checked and repairs carried out when necessary. Modifications were made to the arrangement of the roll-breakers, incorporating a separate drive for these machines and eliminating the necessity for counter-shafting.

Labour.—Labour was found to be hardly adequate for all works, including T.R.I. requirements, and line accommodation is rapidly becoming a problem. It is proposed to build a block of 4 rooms, according to Dr. Macdonald's revised plan for double storied lines, in 1956.

Medical.—Early in the year a Morris Minor station wagon was purchased for the use of the Dispenser, to enable him to visit the lines on both St. Coombs and Mattakelle estates. This vehicle was converted by the Agents in Ceylon to enable a stretcher to be fitted, so that in the event of an emergency case occurring on the estate suitable transport is available to take patients to the maternity ward or hospital.

General.—1955 proved to be a most satisfactory year both for crop harvested and prices realised. The bushes appear to be healthy and vigorous and the excellent cover of tea is being maintained.

E. S. ROSE,
Superintendent.

METEOROLOGICAL OBSERVATIONS—1955.

ST. COOMBS

(Laboratory Gauges)

MONTH	TEMPERATURES °F						Mean Relative HUMIDITY %	RAINFALL		RAINY DAYS		SUNSHINE	
	Mean Maximum	Difference from average (25 years)	Mean Minimum	Difference from average (25 years)	Adopted Mean	Mean on grass		Inches	Difference from average (25 years)	Days	Difference from average (25 years)	Hours	Difference from average (25 years)
January	72.3	— 1.8	58.7	+ 3.0	65.5	52.9	73	4.56	+ 0.96	14	+ 4	156.60	— 36.10
February	73.6	— 2.7	56.9	+ 2.3	65.3	53.7	72	5.47	+ 3.12	12	+ 4	139.80	— 70.88
March	75.5	— 2.2	56.1	+ 0.6	65.8	53.5	73	4.24	— 0.30	15	+ 3	231.65	— 1.36
April	75.3	— 2.1	56.9	— 0.9	66.1	51.8	78	6.82	+ 0.45	16	—	185.85	— 10.59
May	70.6	— 1.8	60.1	+ 0.4	65.4	58.3	86	11.88	+ 0.60	23	+ 5	121.42	— 42.58
June	66.0	— 4.6	59.9	— 0.5	63.0	60.3	92	24.42	+ 11.32	30	+ 4	29.55	— 62.49
July	68.8	— 1.4	58.3	— 1.2	63.6	57.8	86	9.37	— 2.37	23	— 3	112.22	+ 7.03
August	70.8	— 0.2	58.4	— 0.8	64.6	54.7	82	3.65	— 5.77	16	— 9	142.12	+ 27.96
September	71.7	— 0.5	56.5	— 1.7	64.1	54.3	87	10.68	+ 2.31	22	+ 1	124.13	— 16.19
October	71.1	— 2.0	56.7	— 1.0	63.9	54.7	84	6.48	— 3.21	15	— 7	152.25	+ 2.89
November	70.4	— 3.1	56.3	— 0.8	63.4	53.7	84	4.73	— 2.69	15	— 4	142.77	— 18.75
December	71.9	— 1.6	54.5	— 1.6	63.2	52.4	76	0.90	— 4.32	6	— 9	201.78	+ 32.55
	71.5	— 2.0	57.4	— 0.2	64.50	54.84	81	93.20	+ 0.10	207	— 11	1740.14	— 188.51
	Means							Totals					

REPORT OF THE DIRECTOR FOR THE YEAR 1955

Following the announcement of his intending resignation at the end of last year Mr. Lamb left Ceylon on the 17th May, 1955. The Board subsequently appointed the then Deputy Director and Plant Physiologist, Mr. G. B. Portsmouth, Director in succession to Mr. Lamb. It is pleasing to record that prior to his departure from St. Coombs, presentations were made to Mr. Lamb on behalf of both the Planters' Association of Ceylon and the staff of the Institute in appreciation of his long record of valuable service to the tea industry.

My appointment as Director rendered it impossible for me to continue as Plant Physiologist and the Board accordingly gave their approval to this post being advertised as vacant. Numerous applications have been received and it is expected that the appointment will be made early in 1956.

The eleventh biennial Conference was held in Nuwara Eliya on February the 25th-26th, where it was opened by His Excellency Sir Oliver Goonetilleke, G.C.M.G., K.C.V.O., K.B.E., Governor General of Ceylon. The Conference was repeated in Colombo on March the 4th-5th, at which sessions the Hon'ble Mr. J. R. Jayawardene, Minister of Agriculture and Food, was the principal speaker.

The general theme of the Conference was replanting and new planting. All aspects of this subject were dealt with by the various technical officers concerned and the very valuable part in the future expansion of Ceylon's tea production which could be played by the high yielding, high quality, clonal material now being vegetatively propagated by the Institute was particularly stressed. Future prospects for tea and the commercial considerations involved in replanting were also dealt with by visiting speakers. A notable visitor was Dr. W. Wight from Tocklai who addressed the Conference on "Selection and seed policy in Assam".

The expansion of the vegetative propagation programme began in earnest during the year with the establishment of two new clonal proving stations. At Passara a very generous offer from the Nayabedde Estates Co. Ltd., to give the Board a long lease of about 25 acres of patna land on Gonakelle Group at a nominal rental was gratefully accepted. The area leased includes the former Tea Research Institute Sub-station and continued possession of these buildings is accordingly assured. An officer in charge of this Uva proving station is already in residence and the preliminary work of preparing the land nearing completion. At Peradeniya suitable land has been made available by the School of Agriculture and here again preparatory work is going ahead.

Another very generous offer from the Neuchatel Estates Ltd., to give the Board a long lease, at a nominal rental, of 25 acres of very suitable old rubber land on Neuchatel Group has also been accepted. Work in connection with the establishment of the low-country proving station is expected to begin early in 1956.

For making these developments possible our thanks to the Directors of the Nayabedde Estates Co. Ltd., the Directors of Neuchatel Estates, Ltd., and the Principal of the School of Agriculture are gratefully recorded.

Another important research development during the year was the acceptance by the Board of an offer from Messrs. Fisons Pest Control, Ltd., to second to us, for a minimum period of two years, an experienced research entomologist to make a special study of the shot-hole borer problem. Dr. E. Judenko arrived in August and has established a laboratory at Millawitiya near Ratnapura. To assist in this work Mr. G. D. Austin agreed to postpone his intended retirement and to continue in the service of the Institute for a further two years on a fixed contract.

A new manurial experiment comprising 162 plots and covering over 8 acres was laid down on Endane estate Kahawatte, during the year. The experiment is a long term one and is designed to provide information on the manurial requirements of tea under low-country conditions.

Following the acceptance of the Report of the Board of Survey at the end of 1954, special expenditure of Rs. 170,000 on repairs and decoration of staff houses, and of Rs. 64,000 for additional furniture and furnishings was sanctioned by the Board. Much of this work was completed during the year and the additional furniture required purchased and issued to the staff. The main approach road to the laboratory was also much improved and considerable attention given to the general layout. As a result it can be said that the Institute now presents a generally smart and well kept appearance in keeping with its status. Details of the work carried out will be found in the report of the Maintenance Engineer.

Lack of accommodation on St. Coombs for existing staff, let alone any additional staff, again continued to hamper any expansion of the Institute's activities. This matter accordingly continued to receive attention during the year, in consequence of which the building programme was considerably revised. The programme approved by the Board for 1956 now provides for the building of 4 senior and 2 junior staff houses, 3 double block quarters for minor employees and 1 double block of servants' quarters.

By the end of the year the large scale contour survey of the development area on St. Coombs, which is required by the Government Town Planner, was well under way. Approval had also been given in principle to a new water supply scheme for St. Coombs and the services of a suitable Consulting Engineer secured. It may, therefore, be confidently expected that before another year has passed the end of the Institute's accommodation and water supply troubles will be in sight.

Attention may also be drawn to the record yield of over 1,100 lbs. of made tea per acre secured by St. Coombs estate. The fact that this yield was obtained without any detriment to the prices realised by St. Coombs teas on the Colombo market should reassure all those who erroneously believe that high yields are associated with low prices.

Details of the work carried out by the Institute during the year will be found in the various reports which follow.

G. B. PORTSMOUTH,
Director.

REPORT OF THE AGRICULTURAL CHEMIST FOR THE YEAR 1955

General.—With the resignation of Mr. J. Lamb in May 1955 the programme of research of the Biochemistry department came under the control of the Agricultural Chemist. No other staff changes occurred.

In both the Chemistry departments long term research programmes were drawn up, based on anticipation of future developments in the tea industry, and designed to provide the fundamental chemical knowledge which is essential if the research is to keep ahead of problems in practice.

Modern research methods, for speedier and more delicate analyses, bring their own problems with laboratory equipment and design. Fortunately we have been given every facility for modernising the laboratories with the latest apparatus and materials and by the end of 1955 stocks had reached a reasonable level and renovations were begun on four of the laboratories.

AGRICULTURAL CHEMISTRY

Soil Survey.—This survey has concentrated on the effect of cultivation on soil conditions under varying climates, but on soil which is remarkably similar throughout the Ceylon tea growing districts. These are distributed over an area roughly 130 miles by 100 miles, where the terrain plays a large part in governing the rate of work, and by the end of 1955 it was decided to conclude the survey as the field work was occupying so great a proportion of our time. By then, samples of the two top six inch layers of soil had been taken from 160 points in tea fields and from 60 points in adjacent jungle.

These samples were deliberately chosen to cover the variations found in agricultural practices and in the topographical features, in rainfall and in the mean temperature.

It is sufficient here to say that geological evidence suggests that the soils under consideration were formed under similar conditions, and that in comparatively recent times two block uplifts of the parent rock have brought them to their present state, ranging from sea level to over 7,000 feet. This is supported by observation of the way in which the soils lie on the bed rock and by the relatively unweathered appearance of boulders scattered through the profile. The most remarkable feature of these soils is their water stability, and the rapidity with which heavy rains pass through them, and in general we may assume that variations in soil factors have come about *in situ* and are not complicated to an appreciable extent by erosion.

Even in tea which was planted 80 years ago, often on a 30° or 40° slope and with the planting rows running up and down the slope, it is obvious that very little soil has moved downhill. Steep slopes are common, and indeed it is unusual to find flat land of any extent under tea, as the valley soils are not sufficiently well drained to support tea and the hill crests are sharp.

Rainfall varies from 55 inches to over 250 inches, averaging about 110 inches, and there are two rather different distribution patterns. In the south west monsoon zone there are usually no more than two months when little rain falls and the remaining months may be very misty. In the north east monsoon zone the rainfall, from 55 inches to 140 inches, is concentrated into seven months with fewer mists, and five months are often very dry.

Mean annual air temperature is very closely linked with elevation, varying from 82°F in the low country to 59°F at 6,000 feet. Frosts are extremely transient above 5,000 feet and probably have no direct effect upon the soil. Measurements of soil temperature have been started, but continuous thermographic records are essential to get a true picture of how soil temperature can affect soil conditions, and how it is related to certain cultural practices, and to detailed climatological variations.

Although tea at lower elevations is pruned more frequently than at the higher elevations, the shorter pruning cycle is so associated with the rate of growth that there is not a great difference between the proportionate times of exposure of the soil over the elevation range. Fashions in soil cultivation have changed periodically, but as a whole the cultivation is similar for all elevations and climatic districts at any one period. Cultivation on Ceylon tea estates is very light and only rarely is a layer of soil actually turned over, the large fork being used to loosen the top 6 to 8 inches by a crowbar action and the small weed scraper being used on the surface, as its name implies.

The majority of the tea estates were planted on jungle land, either directly, or following coffee, cinchona, etc. and with the density of cultivation it has not always been possible to find samples from adjacent jungle. Whenever such samples were taken, however, we made sure that the jungle had not been cultivated in any way. This is quite easy to deduce as the jungle flora is extremely slow to regain its original form once it has been disturbed.

Patana, the Ceylon grassland, soon reverts to the original after it has been cultivated, and, as patana areas near estates have almost invariably been cultivated or else burned over annually it was decided to omit such unreliable samples. Variations from 1.5 to 20 per cent. in organic matter have been found in patana soils, at the same elevation.

This brief account of the area to which the survey applies, and of the main agricultural features, has been included for the benefit of those in other countries who may wish to compare our findings with their own.

(1) Organic Matter.—A further argument in favour of terminating the survey at 160 sample points was that the results obtained in the carbon and nitrogen analyses fell into a very well defined pattern. The sampling had been as widespread and as comprehensive as possible, and if a well ordered pattern results from such sampling then it may be assumed that it is significant. The dichromate oxidation results for carbon are being compared with the more tedious combustion method. To date, the ratio between the percentage carbon by the two methods seems to be constant for all elevations. All the following results are from the dichromate method, and an approximate factor of x 2 is used to convert carbon to organic matter, although the combustion results suggest a lower factor may be used eventually.

Tea soils from sea level to 2,000 feet show quite a wide scatter in organic matter in the top six inch layer, ranging from about 2 to 4 per cent., but from 2,000 to about 2,600 feet the organic matter suddenly drops to about 2 per cent. At the same time the scatter lessens, and the results from fifteen soils in this narrow elevation range are extremely close together. At elevations above 2,600 feet the organic matter increases in an erratic fashion. As the elevation

increases so also does the scatter. At 7,000 feet an organic matter content of 15 per cent. has been found.

The lower 6 inch layer, 6-12 inches depth, shows the same trends but they are less pronounced, and the scatter at higher elevations is also less. This layer has approximately 75 per cent. as much organic matter as the top six inches.

Nitrogen shows much the same pattern, the sudden decrease appearing at the same elevation, 2,000 feet, but it is not quite so great as with carbon. The rate of increase above 2,600 feet is also slightly less. Thus the carbon-nitrogen ratio is a little lower between 2,000 and 2,600 feet and a little higher at the higher elevations, although as the individual ratios vary widely from 7 to 13 within each range, it is not wise to attach too much importance to the general approximation.

This unexpected drop in organic matter in the mid-country tea soils is more strongly emphasised when comparing them with the jungle soils. Here there is no sign of a decrease, nor do the jungle soils conform to the pattern of the tea soils in remaining more or less uniform in organic matter between sea level and 2,000 feet.

The increase in both organic matter and nitrogen in the jungle top six inches follows a striaght line throughout the elevation range. Up to 3,000 feet, or over, the points conform very closely to the line as opposed to the scatter seen in the tea soils, but above 3,000 feet the jungle points scatter widely.

Up to 1,000 feet jungle and tea soils are very close in their organic matter and nitrogen contents. Between 2,000 and 3,000 feet the ratio is approaching 2:1 and above 4,000 feet the ratio steadily lessens until at 7,000 feet it is near unity.

There is no difference between soils from the two monsoon zones with their differing rainfall distribution.

There is a much greater difference in the jungle between the 0-6 inch layer and the 6-12 inch layer than is found in the tea soils. In the jungle the lower layer has often only half the carbon or nitrogen of the upper layer, and in fact it almost follows the patterns given by the 6-12 inch layer in the tea soils.

The soils in the anomalous elevation range were checked closely and their past history shows them to be as representative of tea growing practice as the rest of the samples. This anomaly must be accepted as representing an increase in soil metabolism at certain combinations of temperature and aeration, the latter brought about by cultivation.

One practical implication is obvious, that every effort should be made to supply the soil at these elevations with organic matter, even though this will be decomposed very rapidly. Surface mulching as opposed to forking it in would, probably, give better results. A less commonly appreciated implication will be mentioned in the next section.

(2) Moisture Equivalent.—This is a term used to denote the amount of water which a soil will retain after being subjected to forced drainage. All laboratory methods of soil analysis must be correlated with field observation before they can be of use to agricultural practice. Sometimes the direct application is difficult, and, as in this case, indirect deductions are of more value.

Three main soil constituents contribute towards the retention of water, these being organic matter, clay, and hydroxides of iron and aluminium. Using the survey samples it was found that the moisture equivalent did not

increase as rapidly as the increase in organic matter would have led us to expect. There was no depression in the 2,000 to 2,600 feet range, and jungle and tea soils had very similar moisture equivalents. This suggests that one of the effects of cultivation has been to increase either the clay fraction or the hydroxides, or both, and also that these two constituents have become of more importance in the lower elevation soils.

This is being studied at the moment and the results may have a great bearing on manurial practice. All the soils under analysis have been acid, often strongly so, with a mean pH for tea soils of 4.7. Jungle soils have a higher pH of 5.1. With increasing rates of manuring with an acid mixture the acidity of tea soils may be expected to increase more rapidly in the future, and although tea demands an acid soil we must not ignore the fact that the soil itself has to function efficiently in many ways if the tea bush is to grow at its best. Acid soils are known to fix phosphate and potash in forms which plants find difficult to utilise, and the clay and hydroxide fractions play the largest part in this process. Organic matter often counteracts the fixation.

This aspect of manuring has been sadly overlooked in Ceylon tea growing, and we cannot afford to let the matter rest.

The survey has already given indications of a combination of conditions which may prove dangerous, and more fundamental studies are obviously needed. It would not be surprising if different manure mixtures were found to be necessary for different elevations.

We should like to thank all the superintendents who have helped with facilities for taking samples and with the agricultural information supplied. Also, our colleagues have on several occasions saved our time on long journeys when time would otherwise not have been available.

Field Experiments.—Our thanks are also due to the superintendents and principals of Abergeldie and Sapumalkande estates, who have been very helpful in their offer of land and labour in two long term field experiments. Special manuring is superimposed upon estate manuring in both experiments and is done by the Chemistry department staff. All other operations are according to normal estate practice, and the estates keep records of the green leaf from each plot.

(1) Abergeldie Estate—Magnesium Experiment.—This is a randomised block, 4 × 4, with one fortieth of an acre plot size, and the four treatments are:—

Control
Crushed dolomite—5 cwt. per acre per cycle
Burned, slaked, dolomite ,,
Epsom salts—200 lbs. per acre per annum

This is a simple trial of the three main sources of magnesium, on old tea showing slight magnesium deficiency, under a heavy rainfall of 180 inches. The pruning cycle is of 3 years and the elevation is 3,700 feet. The slope is gentle with a northerly aspect.

(2) Sapumalkande Estate—Calcium and Potash Experiment.—This experiment is a simple factorial with three treatments superimposed on the normal estate manuring:—

High potash—normal potash
High pH—normal pH
High calcium—normal calcium

These three treatments will be combined in such a way that the interactions between potash, soil pH, and calcium can be estimated as well as the direct effect of any single factor.

Slaked lime is being used to raise the pH of some plots to a level which will not affect the tea adversely, and this point has not yet been decided upon. By the time the frequent dressings of lime have had an appreciable effect other small experiments will have given an indication as to the highest safe pH.

The high calcium plots are being treated with gypsum at a rate which will give the same amount of calcium as on the limed plots, without raising the pH.

When these two treatments have brought the soil to the required state they will not be repeated unless the pH falls appreciably. The estate will use potash at a rate depending on the yield and our high potash treatment will always be given at the same time as the estate manuring, and calculated as an extra 50 per cent of potash.

There are 24 one-fortieth of an acre plots at 800 feet on a flat area, under 180 inches of rain. The tea, from seed, is only seven years old and is fish leaf plucked. Also, the seed was sown very closely in a row and is making extremely vigorous growth on an eighteen month pruning cycle.

There may be additional results of value in unexpected directions. The clearing as yet shows no trace of shot hole borer, which is prevalent in the neighbourhood, and we may be able to see the effect, if any, of certain manurial treatments in preventing such an attack from starting. There is also very little of the low-country chlorosis on any of the bushes, and this will be watched in the same way. It has not been possible to follow up the possible connection between manganese and this chlorosis.

Foliar Nutrition.—Again, time has not permitted any development in the suggestion that epsom salts might be included in the copper sprays, but three estates are to carry out trials in 1956 on their own initiative and we shall keep in touch with the results.

A small randomised block experiment is in progress on Edinburgh estate, to whose superintendent we are grateful for allowing us to use a row of a single clone. The aim is to keep rapidly growing shoots, such as are to be found on bushes supplying cuttings for vegetative propagation, regularly sprayed with magnesium as 2 per cent epsom salts plus a wetting agent. The spraying is to be completed early in 1956 and the shoots cut and propagated as soon as the weather is suitable.

There is a possibility that foliage spraying may be the only way to keep such a profusion of young growth supplied with magnesium, and also that if the leaf and internode go into the propagating beds lacking in magnesium the rooting may be affected.

Advisory Work.—Following a note in the *Tea Quarterly* the standard of packing of soil samples sent for pH tests has improved greatly. Unfortunately, the numbers are increasing rapidly, 900 advisory tests being made in 1955, compared with 1,300 tests for research purposes. The increase is largely due

to the popularity of dolomite, an article on which will appear in a future *Tea Quarterly* together with a suggestion as to how superintendents could help to ease the strain on the Chemistry department.

Letters continue to occupy a large part of the Chemist's time, and an attempt will be made to put notes into the *Tea Quarterly* on those subjects which occur repeatedly.

More soils have been sent from intended nursery sites and in many instances the pH was too high to be safe, but it is an easy matter to reduce the pH before the seeds or cuttings have been put out, and many estates have escaped financial losses through sending samples before planting. Town refuse, compost and small jungle pockets in certain districts may be suspect for high pH, and so may river sand, and we advise superintendents to send thoroughly mixed samples of such materials for testing before they are used in nurseries.

We are coming to the conclusion that vegetatively propagated cuttings prefer a rather more acid soil than do seedlings, and that a pH value greater than 5.6 may not be desirable. This does not conflict with the remarks made in the 1954 Report on the pH of soil under mature tea.

BIOCHEMISTRY

In the 1954 report it was stated that a more fundamental approach to the problems of the mineralisation of nitrogen in the soil was being planned, and we can now report that the preliminary work has been completed and a start made on a series of systematic studies.

Analytical techniques have developed very rapidly in the last decade and the Biochemistry laboratories are being adapted to the new methods, which will be used in the main long term research programme. This will follow the relations between the enzyme systems functioning in tea manufacture and the mineral nutrition of the tea bush. Preliminary analyses showed that there was a marked variation in the trace element content of the flush from tea grown at different elevations, particularly iron and manganese. This work will be extended systematically because the trace elements must certainly exert an influence on one or other of the enzyme systems which are of such importance.

Trace element relations with the enzymes will form the starting point of this long term programme and the initial work will fit in very well with the existing soil nitrification series, which offer many free periods between the batches of analyses. As one programme nears completion so the other will gradually take its place.

Soil Nitrogen Cycle.—Mr. Ramaswamy has again conducted this work, which in its new form has involved many hundreds of analyses, but because so much of this has of necessity been devoted to standardisation of technique we do not intend to give any of the results from the soil incubations. In the 1956 report it will be possible to give an indication of the trend of the work.

The findings in the soil survey have given added impetus to the soil nitrification work, and soils from all elevations are under study, with emphasis on the moisture and temperature relations. Ceylon tea soils, with heavy rainfall passing very rapidly through them, should decompose organic matter at a high rate, and it is a point of note that in fact such soils have not lost organic

matter to the extent expected. Both in the field and in laboratory incubations we have found active ammonification and nitrification in soils at a pH as low as 3.7, and acidity can hardly be taken as the cause of the high organic matter levels.

Seasonal Variation in Ammonia and Nitrate.—Complementary to the laboratory incubations is a study of the field variation in ammonia, nitrate, moisture and pH in the 0-2 inch and 2-6 inch layers from a plot on St. Coombs. A second plot has been chosen so that the pH can be raised by liming, and the same analyses are being done while the pH is being adjusted. There is no possibility of either plot receiving drainage from other areas.

The land was opened from patana 24 years ago and the organic matter and nitrogen are high, while the pH is very low.

Depth	pH	% carbon	% nitrogen	C/N
0-2 inches	4.5	6.87	0.44	15.6
2-6 „	4.2	5.75	0.36	15.9

There is normally a mulch of fallen leaves one or two inches thick and the reason for sampling the top two inches of soil separately was the anticipation that under the mulch this layer might show a high biological activity. Samples have been taken once a week with a stainless steel tube auger of 4 inches diameter. This allows uncontaminated soil to be taken from the centre of the cores in the laboratory and the two layers can be kept reasonably distinct. Rainwater analyses are done regularly, but there is no possibility of collecting drainage waters. A recording thermograph will shortly be available for this experiment and soil temperatures will be taken at various depths.

The data from these plots, taken over several years, will give much needed information when correlated with climatic and cultural factors, and will be of great value in conjunction with the incubation results.

Such detailed work can only be done close to the laboratory, as we have found that both ammonia and nitrate increase in a short time when soil is disturbed. Three hours' delay has sometimes doubled the nitrate content, and ammonia begins to increase rapidly after six hours.

Conclusions.—1955 has been a transition period, and with so much of the work in the initial stages it would be unwise to publish interim results, with the danger of drawing wrong conclusions.

J. A. H. TOLHURST,
Agricultural Chemist.

REPORT OF THE TECHNOLOGIST FOR THE YEAR 1955

General.—As usual, there was no falling off in the amount of advisory work carried out by this department. Besides the correspondence normally attended to, 31 visits were made to factories. In addition, quite a considerable part of the Technologist's time was taken up in the preparation of Monograph No. 4—Tea Manufacture in Ceylon.

For the greater part of the year Mr. S. M. Gunaratnam's time was mostly occupied with withering experiments. Fifty separate experiments were carried out. Towards the latter part of the year his time was entirely devoted to trials on an electric stalk extractor, the introduction of which by the Date Iron Works Co. Ltd., of Shizuoka, Japan, aroused considerable interest. An interim report on the performance of this machine has been published in the *Tea Quarterly*, Vol. XXVII, Part I, but a brief reference to it is made in this report.

Withering.—The investigation of withering temperatures was continued with respect to the effect of high temperatures. Two aspects of the problem were studied; one, in which the leaf was spread in the conventional manner and the other, where the leaf was withered in a chamber and spread up to a thickness of about 12″. Mechanical withering, as the latter method is so-called, has all the features common to drum withering except that the leaf instead of being in motion is turned over at regular intervals.

One obvious result from the employment of high temperatures is a considerable shortening of the withering period, but even should the final product be not altered, a factory has little to gain by such a change in withering procedure unless either (*a*) withering costs are reduced or (*b*) a part of the day's crop can be withered in time to avoid a break in continuity of manufacture. However, the fact remains that, apart from the general impression that high temperatures harm the leaf, little evidence is available on the more important factors in association with high temperatures, namely humidity and period.

In the experiments under discussion temperatures higher than those normally employed in artificial withering were examined, and the resultant teas compared with teas made from the same leaf withered for 18 to 20 hours at temperatures below 80°F. The results were as follows:—

(*a*) *Mechanical withering* (23 experiments):—

Temperature	Hygrometric difference	Period	Comparison for quality
90°F	15-20°F	9 hours	Very little to choose between high temperature and control.
90°F	10°F	12 „	Control distinctly preferred
80°F	10°F	12 „	„ slightly „

(*b*) *Tat withering* (27 experiments):—

Temperature	Hygrometric difference	Period	Comparison for quality
90°F	15°F	10 hours	High temperature slightly preferred.
90°F	10°F	11 „	Control slightly preferred
80°F	10°F	12 „	Very little difference

Colour and strength were not noticeably affected probably because of the fact that the higher temperatures were associated with very much shorter periods than the control.

From an examination of these results, it would appear that tat withering has given better results than mechanical withering, but one feature common to both methods is that at a temperature of 90°F (dry) 80°F (wet) quality is impaired. Considering that at the same dry bulb temperature of 90°F no detrimental effect was produced when the hygrometric difference was bigger, the results do definitely direct attention to the importance of the wet bulb temperature in withering.

Hitherto the wet bulb temperature in withering has been considered only in relation to the hygrometric difference. Its effect on the temperature of the leaf has been completely lost sight of. If it is remembered that green leaf behaves exactly like a wet body at the beginning of the withering process and as a partly wet body during withering it is not difficult to understand the significance of the wet bulb temperature. At the commencement of the withering process the temperature of the leaf is approximately equal to the wet bulb temperature of the air, and as withering proceeds the leaf becomes physically less wet and its temperature rises slightly above the wet bulb. From this phenomenon it must be expected that when evaporation of water from the leaf ceases, the leaf attains the dry bulb temperature of the air. It is evident therefore that the influence of the dry bulb temperature in withering cannot be determined unless the wet bulb temperature and the rate of evaporation are known.

These basic principles explain for one thing the difference obtained between withering at 90°F (dry) 70°F (wet) and 90°F (dry) 80°F (wet). They also throw light on the different results given by mechanical and tat withering at high temperatures. It is not unreasonable to assume that in the latter method the temperature of the leaf was generally lower during the whole period of withering as a result of the conditions having been more conducive to better evaporation. In mechanical withering, on the other hand, where the leaf was spread thickly and turned over only at long intervals, evaporation of moisture would have been impeded to some extent and a part of the leaf would thus have assumed the dry bulb temperature of the air. It is for this reason that proper aeration is so essential during withering especially when spreading is thick or when any chamber is used for accommodating the leaf.

From the foregoing it is evident that for high temperatures to give satisfactory results two essential requirements are free and rapid evaporation of water from the leaf, and these can only be met by an adequate volume of air circulating freely and a big hygrometric difference. That is to say, the conditions most favourable to the employment of high temperatures in withering are satisfied when the wet bulb temperature is low and the leaf is not prevented from losing its moisture readily throughout the process.

The conclusions that may be drawn from the experiments carried out so far are that for preservation of quality,

(*a*) a wet bulb temperature of over 80°F appears to be harmful.

(*b*) a dry bulb temperature of 90°F may be employed provided the wet bulb temperature is below 80°F.

(*c*) a wet bulb temperature higher than 70°F but lower than 80°F is permissible provided the hygrometric difference is large enough to enable withering to be completed in less than 12 hours.

On the whole, the indications are that 'forcing' a wither, a practice adopted on some estates, is not detrimental to the main liquoring properties of a tea. It is also evident from a closer examination of individual tasters' reports that the higher the temperature the bigger is the hygrometric difference required to get satisfactory results, otherwise "stewing" conditions are likely to be created which would result in the tea acquiring unpleasant characteristics such as dullness and softness.

The employment of high temperatures and big hygrometric differences will, however, not prove very satisfactory in the conventional withering loft, particularly in a long one, because it will result in a considerably wide variation in the wither from one end of the loft to the other. For rapid withering to be a success, therefore, the leaf must be confined either to a small number of banks or to a chamber in which the whole charge is continuously brought in contact with the air.

Some interesting features of the results obtained from the experiments under discussion have been the marked preference for high temperature withering on a few occasions. In two instances, a high temperature gave better results than a natural wither, in which the period was 18 hours in one case and 27 hours in the other. In another where the respective temperatures were 93°F (dry) 73°F (wet) and 75°F (dry) 67°F (wet) and the period of wither about the same (11 hours approximately) the difference was significantly in favour of the former. On one occasion when the wither was very soft a high temperature of 90°F (dry) 80°F (wet) was actually preferred to the control. The reason is obscure but the connection between the degree of wither (or the moisture content of the leaf) with temperature cannot be overlooked.

A marked preference for teas withered at normal temperatures was noted particularly when flavour was present and a natural wither taken in less than 12 hours. The control was also distinctly preferred in quality on almost all the occasions it was compared with 90°F (dry) 80°F (wet), the only exception being that already mentioned.

If these results are taken in conjunction with those obtained from withering at low temperatures, published in the last annual report, it looks as though the two important considerations in withering as far as preservation of quality is concerned, are:—

(1) The wet bulb temperature.
(2) The period of wither.

The former should be as low as possible and the latter as short as possible to give the optimum conditions for conserving quality in high grown leaf. By raising the temperature of the outside air in the customary manner condition

(2) only will be obtained. For both conditions to be satisfied the only means available is the use of refrigeration and air-conditioning equipment.

In the annual report for 1953, it was shown that there is no significant difference between teas from mechanical withering and tat withering at normal temperatures. In the light of these results as well, it would appear that the use of an air-conditioning plant in conjunction with a suitably designed withering chamber, such as a drum, may well be the solution to the problem of supplementing withering accommodation in up-country factories. The economic development of such a method will of course depend on the cost of a unit, operational costs, and the net value of the teas produced.

The average power consumption of the plant (fans inclusive) used in the experiments referred to was as follows:—

At 60°F	(6°	hygrometric	difference)	1.4 electrical units per lb. of made tea
At 70°F	(8°	„	„)	1.2 do.
At 80°F	(10°	„	„)	0.8 do.
At 90°F	(10°	„	„)	0.7 do.
At 90°F	(15°	„	„)	0.6 do.

On the basis of these figures success on a commercial scale does not appear very promising but it must be remembered that the design of the plant in question was not altogether satisfactory. In the first place the best use was not made of the heat from the compressor and of the cooling effect of the evaporator. The spreading arrangements were also not satisfactory enough to bring out the best from the leaf. There is no reason why an economic improvement cannot be effected by a different type of unit so designed as to use the refrigerant gases more effectively and at the same time provide better conditions for withering. The activities of the Technological department will in the near future be directed towards these objectives.

Greenness of Liquors.—A brief reference to this was made in the last annual report. A closer examination of the problem has since been made and further observations noted with regard to two other possible causes, namely, short firing periods and hard withers.

These investigations confirmed previous results, but at the same time revealed that a high temperature in withering by itself would not reduce the degree of greenness if the period of wither was very short and an uneven wither obtained. Over-withered leaf beyond doubt contributes to the greenish character of a liquor, and the employment of high temperatures in withering must inevitably result in a certain proportion of the leaf being overwithered. It does not follow, however, that because hard withers may cause greenness, soft withers should lead to maltiness. The inherent character of the leaf has to be considered as well. Thus leaf which has a natural malty characteristic can be withered hard without greenness being pronounced whereas in the case of leaf which is intrinsically greenish a hard wither will accentuate the greenish character.

Degree of wither alone therefore gives no clue to the problem unless the following factors are considered as well:—

(*a*) the natural properties of the leaf.
(*b*) the evenness of the wither.
(*c*) the period of wither.

As regards different firing periods, the general indications were that the shorter the period the less malty the liquor, but the more pronounced the quality. Here again the intrinsic character of the leaf plays an important part, the more greenish types not being markedly affected whilst the leaf belonging to the malty class is very adversely affected by a long firing period. A tea fired for 30 minutes for instance was ordinary and stodgy compared to one fired for half the time, which had point and briskness and in the words of one taster 'had more life and sparkle like a fresh soda water'.

The softness induced by long firing periods in a malty tea strongly suggests that maltiness is nothing more than a character possessed by leaf with rapid fermenting properties and greenness a characteristic associated with poor fermenters. Under-withering or high firing temperatures have apparently no connection with these characteristics, and this statement has been borne out by the results of the investigations carried out.

From the knowledge now available, any of the following measures may be adopted to reduce the degree of greenness in liquors:—

(1) softer withers
(2) more even withers
(3) longer withers
(4) longer periods of rolling
(5) longer fermentation
(6) higher fermenting temperatures and,
(7) longer period of firing if it happens to be very short, spreading is too thin, or rapid firing is suspected.

Estates troubled with greenish liquors and desiring to get rid of this characteristic in their teas may find it worthwhile to make the changes in manufacture as suggested but the warning is given that only one change must be contemplated at a time. Care must also be taken that whatever is done quality is not seriously impaired. Except for the first two measures recommended any of the others will result in some deterioration of quality. At certain times of the year, therefore, when quality is at a high level, it may in fact be disadvantageous to attempt to correct greenness. During such periods greenness is readily overlooked by the trade, unless it is so pronounced as to be almost a bitter character.

Greenish infusions may also be improved by the same means, but to expect to give them a 'new' penny look by a change in manufacturing technique is nothing else than a 'pipe-dream'. Since the colour of the infused leaf is not necessarily related to the liquor and is primarily an inherent character, there appears to be a tendency to over-stress its importance. A greenish infusion can be associated with good liquoring properties and cases have been known where, in trying to satisfy the requirement of some sections of the trade for coppery infusions, desirable liquor characteristics have been sacrificed.

Clonal Manufacture.—In addition to the normal assistance given to the Plant Physiology department in quality tests of promising clones 35 clones were manufactured for 9 estates. It is regretted that in many instances owing to shortage of staff and pressure of work the Technology department has not been able to assist some estates.

The position at present with regard to quality tests of clones for estates is that little can be done by the Institute till the proposed clonal testing stations

are established. For the present all possible assistance will be given if estates wishing to have quality tests carried out are prepared to supply cuttings from their own clones for the use of the Institute in the proving trial plots established at St. Coombs. In order to know whether a clone is promising enough to be tested, a *questionnaire* is issued by the Institute, asking for the relevant information. It can be had on application.

With regard to the type of material sent for manufacture it must be stressed that a clone to be tested should be in regular plucking for at least six months and the standard of plucking reasonably good. Tough banji, coarse leaves and a 'stalky' pluck will give misleading results and so will a very fine standard of plucking. The two extremes should be avoided at all costs if a quality test is to prove its worth. Leaf from a bush allowed to grow for the purpose of taking cuttings is also very unsuitable.

Some of the information required from estates for manufacturing tests is given below:—

1. Yield records.
2. Date of last prune.
3. Age at first plucking.
4. Date since when bushes have been in regular plucking.
5. Length of plucking round.
6. Number of bushes to be tested.
7. Total weight of flush.

Another important consideration is the time at which a clone is tested for quality. Some allowance must always be made for the seasonal effect. The need for repeating quality tests is therefore evident.

Stalk Extraction.—The "Shizuoka" electric separator underwent tests in an experimental capacity for removing stalk from tea. Judging from the results obtained, certain modifications appear to be necessary before the machine can be considered a hundred per cent efficient. Nevertheless, in its present form it can be used with success for extracting stalk from a proportion of the day's make with a resultant reduction of at least 50 per cent. in the overall cost of hand-picking. The machine appears to be suitable only for the separation of light stalk usually found in the B.O.P., Fannings and Dust grades. The heavier stalk present in the B.P. and Pekoe grades is difficult and almost impossible to extract.

The Myddelton Stalk Extractor, on the other hand, according to recent observations, seems to be suited for separating some of this heavier stalk, provided it is used in conjunction with a 'breaker'. When stalk and tea are subject to slight pressure, a difference in length between stalk and tea is obtained, which facilitates the separation. By using a 'breaker', therefore, the Myddelton machine has given far better results than those obtained when it was first tried out at St. Coombs (*vide* T.R.I. Annual Report for 1951—*Bulletin No.* 33—page 32).

Accordingly it would not be presumptuous to expect that once these two machines are perfected their employment together will eliminate the long and tedious process of hand-picking. Perhaps only in the case of the O.P. grade will it be found necessary for hand-picking to continue.

Miscellaneous.—(1) Crop Protection Experiments—33 separate manufactures were carried out on a miniature scale for the Entomological and Mycological departments on 22 occasions.

(2) Foliar nutrient spraying—Further manufactures revealed no difference in the teas from treated and untreated areas.

(3) The "Kaybee" infra-red moisture tester. Type X15—The operation is exactly similar to that of the X14 model, but owing to the range being 0-15 per cent., the sensitivity is greater and more care has therefore to be observed in the setting of the instrument before it is used.

Tests carried out on a 220/230 A.C. model on samples of tea varying from 2 to 12 per cent. in moisture content gave the same satisfactory results as those obtained with the X-14 type (*vide Tea Quarterly*, Vol. XXV, Part IV, pages 93-95).

The availability of such an instrument, which apart from its relatively low cost is easy to operate, makes it imperative for every factory to possess one. Factories not having a steam oven and moisture balance are well advised to acquire an infra-red moisture tester.

Acknowledgments.—The valued and continued assistance from the tasters in Colombo and London in the tasting of experimental samples is gratefully acknowledged. As in previous years such assistance has always been freely given and we are greatly indebted for all the co-operation received.

E. L. KEEGEL,
Technologist.

REPORT OF THE PLANT PHYSIOLOGY DEPARTMENT FOR THE YEAR 1955

Following the announcement in November, 1954, of Mr. J. Lamb's forthcoming resignation from the post of Director much of his duties were handed over to the Plant Physiologist, Mr. G. B. Portsmouth, who was subsequently appointed Director. As a consequence the responsibility for the work of this Department largely devolved upon Mr. F. H. Kehl and Mr. M. Piyasena, the two senior assistants. The results recorded in this report are therefore chiefly due to the initiative of these two officers.

General.—Mr. A. C. B. Pethiyagoda was appointed on 1st August, 1955. After a period of training on St. Coombs he was placed in charge of the new clonal proving station at Passara.

613 letters were received and 563 despatched.

30 estate visits were made, and 6 Planters' Association Meetings attended during the year.

Selection and Vegetative Propagation.—During the year six new clones were planted and cuttings of 56 new clones from 16 outside estates were put out in the nursery; where they have made staisfactory growth. These clones will be put out in test rows in 1956. No new clones were selected on St. Coombs.

(1) 1947 Clonal Area.—These clones completed their 2nd year of plucking in the second cycle. The calculated yields and manufacture results of the better clones are shown in table 1.

Table 1.—1947 *clonal area calculated yield for 2nd year of 2nd cycle and manufacture results for 1st cycle.*

Clone	Calculated yield lbs. per acre	MANUFACTURE			
		No. of tests	Above Avg.	Average	Below Avg.
2024	4,075	8	6	2	–
2026	3,515	2	–	–	2
2025	3,645	3	1	2	–
2046	3,415	2	–	–	2
2016	3,005	4	1	2	1
2043*	3,005	3	–	–	3
2023	2,460	3	2	1	–
2022	2,275	4	2	2	–
2021	1,335	4	4	–	–

*Red leaf type.

All clones except No. 2021 are maintaining their high yields. The drop in yield of this clone may be attributed to meadow eelworm, (*Pratylenchus pratensis*) infestation. This clone appears to be susceptible to this pest.

Observations on the formation of banji were continued. Table 2 gives the results to the end of the 2nd year of the 2nd cycle.

Table 2.—1947 *clonal area. Perecntage of banji by weight. First and second year of 2nd cycle.*

CLONE	AVERAGE BANJI PERCENTAGE BY WEIGHT									
	FIRST YEAR				SECOND YEAR				1st Yr.	2nd Yr.
	Plucks 1–10	Plucks 11–20	Plucks 21–30	Plucks 31–40	Plucks 1–10	Plucks 11–20	Plucks 21–30	Plucks 31–40	Plucks 1–40	Plucks 1–40
2024	12.9	32.1	52.8	46.1	56.8	55.4	51.6	52.0	38.1	54.0
2026	20.3	31.8	43.5	40.7	46.0	31.0	51.1	58.6	34.0	48.3
2025	24.9	39.0	62.0	52.7	55.7	45.9	57.9	57.7	46.8	56.5
2046	10.4	21.8	36.2	31.2	27.8	45.0	36.5	35.8	26.7	35.9
2016	18.3	38.2	50.9	48.0	46.1	55.5	59.1	61.0	40.1	55.1
2023	16.3	19.8	41.4	31.2	31.1	30.5	36.6	45.5	27.6	36.8
2022	17.8	41.7	60.8	57.5	59.6	58.1	67.6	78.2	45.3	65.7
2021	19.3	32.9	41.7	45.1	38.5	39.0	54.9	48.0	33.4	45.0
25	20.0	34.5	44.3	55.1	58.9	39.2	50.6	68.5	36.3	55.4
23	13.0	18.5	24.6	31.6	41.2	29.9	39.5	43.3	22.4	38.9
MEAN	17.32	30.06	45.82	43.92	46.17	42.95	50.54	54.86	37.07	49.16

The percentage of banji continued to increase with age from pruning. In the second year from pruning nearly half the crop harvested consisted of banji.

Table 3.—*St. Coombs clonal yields. Lbs. per acre for 1st year.*

CLONE No.	ESTATE SCALE PLANTINGS		Clonal test lines
	Date of Planting	Yield	
18	May 1952	245	350
23	do.	655	600
25	do.	805	685
216	do.	590	645
740	do.	575	415
777	do.	650	510
1114	do.	825	825
1526	do.	1,145	675
2024	do.	1,115	1,240

The yield figures for the clonal test lines recorded in table 3 are obtained from 30-40 unit rows of each clone. This is not the best method of assessing the yielding capabilities of a clone but is the simplest, and has proved to be satisfactory on comparing the yields for the first year of some of the clones planted on a field scale with that of the test rows.

The yields of some of our clones which were put out in a clearing on Gonakelle estate, Passara, in November 1952 are even more encouraging when compared with our test rows.

Table 4.—*Mortlake Division, Gonakelle Estate, Passara. Clonal yields, lbs. per acre, 1st year.*

Clone No.	ESTATE SCALE PLANTING		CLONAL TEST LINES St. Coombs
	No. of bushes	Yield	
777	277	1,045	510
1114	1,837	1,268	825
1294	8,100	1,096	395
1526	1,126	1,774	675
2024	412	2,019	1,240

It is most encouraging to note that all clones have given over 1,000 lbs. made tea per acre in their first year of plucking.

(2) Blister resistant area.—Clones in this area completed their first pruning cycle. They were given a light prune in May. As cutting material of some of these clones was required for planting, plucking had to be delayed. The yields of some of the better clones, together with the manufacture results for the first cycle are shown in table 5.

Table 5.—*Blister resistant area. Calculated yields and manufacture results 1st cycle.*

CLONE	CALCULATED YIELDS LBS/ACRE				MANUFACTURE			
	1st Yr.	2nd Yr.	3rd Yr.	Mean	No. of tests	Above Average	Average	Below Average
Ken/16/3	1,700	1,800	2,625	2,042	3	1	2	–
TK48	1,040	1,735	2,560	1,778	2	–	–	2
Kew4/A4	940	1,815	2,410	1,772	3	–	1	2
D	1,050	1,535	2,275	1,620	3	1	2	–
Ken15/2	825	1,550	2,425	1,600	3	1	–	2
2065	1,000	1,305	2,220	1,508	3	–	1	2
OK4	940	1,320	2,260	1,507	3	1	–	2
2086	925	1,485	1,665	1,358	3	2	1	–
B.No. 8	955	1,220	1,850	1,342	3	1	–	2

(3) Clonal cuttings.—A limited number of cuttings of each of our so-called "approved clones" were given to estates to establish their own test plots. 126 estates in 31 planting districts received over 100,000 cuttings. There was a big demand for cuttings of clone 2024; most estates being interested in this clone. It is undoubtedly one of our best, but there is no guarantee that it will do equally well under conditions quite different to St. Coombs. Furthermore the policy of confining one's attention to a single clone is not a sound idea.

The Institute is quite willing to assist estates by supplying clonal material, free of charge, as and when cuttings are available. Estates should also try to

Table 6. *Total number of cuttings with bark damage and the total number of white grubs found.*

BLOCK	BARK DAMAGE										WHITE GRUBS									
	D—D		Intox		Clordox		Agrocide		Control		D—D		Intox		Clordox		Agrocide		Control	
	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*	1*	2*
1	0	2	0	0	0	0	2	5	2	12	0	0	0	0	0	0	1	1	1	2
2	0	0	0	2	0	0	0	3	2	7	0	1	0	1	0	0	0	2	0	0
3	0	0	0	6	0	0	6	3	5	11	0	0	0	2	0	0	0	1	2	3
4	0	0	1	7	0	0	3	6	4	10	0	0	0	1	0	1	1	2	1	3
TOTAL	0	2	1	15	0	0	11	17	13	40	0	1	0	4	0	1	2	6	4	8

1* = Examination after 3 months.
2* = Examination after 5 months.

make their own selections as there is no valid reason to suppose that the best bushes are to be found on St. Coombs which is a very small estate. The characteristic of high yield is likely to be as freely distributed amongst bushes in every estate, and can be located if only trouble is taken to look for it.

(4) Pre-treatment of nursery soil.—The experiment referred to in our annual report for 1954, Bulletin No. 36, page 41, was completed. The treatments were as follows:—

(1) Shell D.D. fumigant 5 cc. injected to every six inches on 9th September, 1954.

(2) Intox 8 diluted to 1 in 2000 and applied at the rate of 3 gallons per 16 square feet on 5th October, 1954.

(3) Clordox diluted to 1 in 2000 and applied at the rate of 3 gallons per 16 square feet on 5th October, 1954.

(4) Agrocide. 4 teaspoonfuls applied per 16 square feet on 5th October, 1954.

(5) Control—Untreated.

Prior to treatment all blocks were thoroughly cultivated to give equal conditions; the treatment was such that any eggs of sub-surface insects, particularly species of *Anomala*, would have been well distributed and not left concentrated in spots.

Cuttings were examined at 3 months and 5 months after planting; 50 cuttings being examined on each occasion. The results are given in table 6.

The above results show that all the treatments are effective; Intox 8 giving better control than Agrocide, but the protection afforded by D-D and Clordox is superior to that of Intox 8 and Agrocide.

On account of the smallness of the plots, the experiment may be regarded as a preliminary one, although the results do suggest that pre-treatment of soils does protect cuttings from damage by harmful elements of the soil fauna.

After 5 months 50 cuttings were examined for rooting. Results are given in table 7.

Table 7.—*Number of cuttings rooted after* 5 *months.*

Block	D—D	Intox 8	Clordox	Agrocide	Control
1	47	47	45	42	40
2	44	39	41	42	40
3	50	44	50	44	31
4	48	45	42	46	38
TOTAL	189	175	178	174	149
MEAN	47.25	43.75	44.50	43.50	37.25

None of the treatments have had an adverse effect on rooting. On the contrary they have given better results than the control.

(5) Cuttings from clean pruned and cut-across bushes.—(a) Bushes clean pruned in March 1953. The first lot of cuttings was removed six months after pruning, *i.e.* September 1953. Subsequently cuttings were taken at intervals of approximately 4 months *i.e.* January 1954, May 1954, September 1954, December 1954, and March 1955. At each harvest of cuttings all shoots that had developed sufficiently for making cuttings were cut back. Cuttings taken in March 1955 were compared with (b).

(b) Bushes treated as in (a) until September 1954, when they were clean pruned. Cuttings taken in March 1955 were compared with (a).

Table 8.—*Total number of cuttings rooted, dry weight of roots and dry weight of shoots per* 100 *cuttings at the end of* 10 *months.*

Clone	Number rooted		Weight of roots in gms.		Weight of shoots in gms.	
	Cut across	Clean pruned	Cut across	Clean pruned	Cut across	Clean pruned
25	50	61	2.43	3.89	9.62	13.21
777	60	78	4.40	5.92	15.16	17.62
1526	74	76	5.20	6.92	13.42	16.45
2025	65	82	5.82	7.68	15.23	16.92
TOTAL	249	297	17.85	24.41	53.43	64.20
MEAN	62.25	74.25	4.46	6.10	13.36	16.05

The results recorded in table 8 indicate that the continuous removal of cuttings without occasionally resorting to clean pruning does result in lower rooting. It is also evident from this table that the cuttings taken from clean pruned bushes have produced better growth below ground as well as above, as is shown by the dry weight of roots and shoots.

The conclusion from the above experiment is that it is advantageous to periodically light clean prune bushes that have been allowed to grow up for the purpose of getting cutting material. The experiment does not give an indication as to the frequency of resorting to a clean prune. From observation, however, it seems likely that bushes should be clean pruned about every 18 months at this elevation.

(6) Clonal proving stations—Passara.—Preliminary work in connection with the establishment of a clonal proving station was started at Passara. An area of about 6 acres has been cleared, drained, terraced and planted with Guatemala grass. Grevilleas have been planted as wind belts all round the proposed clonal area. Outside this area too wind belts have been established so that as much protection would be given to the young tea as possible. This protection is very necessary as the area available for planting is rather exposed.

(7) Peradeniya.—Assistance was given to the experimental station in opening a nursery and planting cuttings of over 100 clones. The site chosen for the nursery though not quite satisfactory was the best that was available.

Weed Killers.—The experiment referred to in Annual Report for 1953, Bulletin No. 35, pages 41 and 42, was completed.

The treatments were:—

(*a*) Fernoxone (sodium salt of 2, 4-D) applied at a rate of 2½ pounds in 60 gallons of water per acre plus 0.5 per cent Teepol.

(*b*) Phenoxylene 30 (sodium salt of MCPA) applied at a rate of 2/3 gallon in 60 gallons of water per acre plus 0.5 per cent Teepol.

(*c*) Atlacide (sodium chlorate) applied at a rate of 15 pounds in 60 gallons of water per acre plus 0.5 per cent Teepol.

(*d*) Control—hand weeding.

Table 9.—*Yields from* 23-3-53 *to* 7-12-55 (110 *pluckings*).

Weedkiller	YIELD, POUNDS PER ACRE			
	1st year 23-3-53 to 8-3-54	2nd year 16-3-54 to 11-3-55	3rd year 21-3-55 to 7-12-55	TOTAL 23-3-53 to 7-12-55
Fernoxone	1,331.94	1,323.63	818.79	3,474.36
MCPA	1,318.09	1,293.55	821.53	3,433.17
Atlacide	1,345.11	1,329.61	823.80	3,498.52
Hand weeded	1,307.44	1,322.66	821.68	3,451.78

The yields since the commencement (table 9) show that none of the weedkillers at the quantities applied have had any adverse effect. This is due to the very careful supervision in the application. Any careless spraying would have caused damage to the tea itself resulting in some loss of crop. All the weedkillers were effective in controlling most common broad leaves in tea. Grasses, however, particularly *Digitaria* sp., were almost unaffected and were removed by hand.

All weedkillers were applied 14 times during the 3 year cycle, viz: 7 times during the first, 5 times during the second and twice in the third year, at an average rate of 1.36 pounds Fernoxone, 1.64 litres MCPA and 8.44 pounds Atlacide per application per acre respectively.

The total costs for the 14 applications of these weedkillers including Teepol for 3 years are Rs. 91.68 for Fernoxone, Rs. 114.84 for MCPA and Rs. 124.85 for Atlacide as compared with an estimate of Rs. 32.03 for hand weeding. The quoted figures do not include the cost of removal of grass and cost of the actual application of the weedkillers which would be approximately Rs. 5.00. Thus it is clear that the cost of chemical weed control compares very unfavourably with that of hand weeding. Treatment with the available weedkillers does not, therefore, appear to be capable of replacing other aspects of good bush management.

Banji Formation.—(1) On fish leaf plucking experiment.—A study in banji formation in the different plucking treatments was made during the 3rd year of the 5th cycle. The results obtained to date indicate the type of plucking adopted has an influence on banji formation.

The plucking treatments are:—

1. Continuous normal plucking (leaf plucked to single leaf).
2. Continuous fish leaf plucking (leaf plucked to fish leaf).
3. Previous cycle normal—this cycle plucked to fish leaf.
4. Previous cycle plucked to fish leaf—this cycle normal.

Table 10.—*Average percentage banji by weight—35 pluckings.*

Treatment	1	2	3	4
Block 1	50.18	67.30	66.08	48.56
„ 2	57.85	68.85	68.86	53.39
„ 3	54.92	68.31	70.12	55.27
„ 4	57.55	74.96	72.51	59.11
Mean	55.13	69.86	69.54	54.08

The analysis of the data recorded in table 10 has shown the following:—

(1) Definite increase of banji by weight on treatment 2 compared with treatment 1.

(2) Treatment 3, normal plucking in the previous cycle shows an increase of banji by weight when hard plucking is resorted to.

(3) There is no difference between treatments 1 and 4 *i.e.* where normal plucking is substituted for fish leaf plucking.

(2) On T4 area—Positional influence on formation of flush and banji.—An experiment designed to observe the positional influence on the formation of flush and banji, *i.e.* above, below or level, 0-6″, 6-12″ and 12-18″ from the centre of the bush gave the following results so far for two years' of plucking:—

(1) There is an increase of banji number below the plucking table as compared with above and level (table 11).

(2) There seems to be a slight increase in the average banji percentage by weight moving from the centre of the bush to the periphery (table 12).

(3) There is no significant difference in the total number of plucked shoots (flush and banji) per unit area in the different zones namely, 0-6″, 6-12″ and 12-18″ from the centre of the bush (table 13).

Table 11.—*Average banji number per pluck.*

Bush	TREATMENTS		
	Above plucking level	Below plucking level	At plucking level
1	2.48	28.53	3.29
2	3.02	30.06	3.58
3	3.63	31.75	3.81
4	2.83	20.75	3.04
5	2.77	21.44	2.90
MEAN	2.95	26.51	3.33

Table 12.—*Average banji percentage in different zones.*

Year	ZONES		
	0—6″	6—12″	12—18″
1st year	43.34	45.49	49.62
2nd year	43.42	49.29	52.96
MEAN	43.38	47.39	51.29

Table 13.—*Number of flush and banji per square inch.*

Bush	ZONES		
	0—6″	6—12″	12—18″
1	1.96	1.75	1.77
2	2.41	2.48	2.34
3	2.27	2.37	2.23
4	2.19	2.36	2.22
5	2.65	2.26	2.01
Mean	2.30	2.25	2.12

Fish Leaf Plucking Experiment.—Report at the end of the 5th Cycle.—The experiment on fish leaf plucking has completed its fifth cycle.

At the end of the last cycle it appeared that the general low level of yield was due to overall potash deficiency and the potash application was doubled, viz: from 20 to 40 pounds per acre. A heavy shade of *Albizzia moluccana* which had existed from the very inception of the experiment was also removed. As a result the yield in both plucking treatments was considerably increased.

In the current cycle the plots plucked consistently to the fish leaf have produced a higher yield than those plucked to the single leaf. This is in marked contrast to the results of the past three cycles where the plots plucked to the fish leaf yielded less than those plucked to the single leaf.

Although the fish leaf plots produced a higher yield, there has been no apparent improvement in the condition of the bushes which have severely deteriorated as a result of continuous fish leaf plucking over a long period. In this connection it is of interest to note that the amount of leaf droppings from pruning which contribute a supply of organic matter to the soil is only about 1/3rd that from the normal plucked plots. The reduction in size of the bushes further exposes a larger area of soil surface to erosion and to the scorching effect of the sun; weed growth is also considerably increased.

The fish leaf treatment has shown a better crop response to the increased application of potash than the single leaf treatment. As this development was noted only in the present cycle this should not be regarded as anything but an interim statement.

The figures are shown in the table 14:—

Table 14.—*Dry matter distribution for continuous plucking treatments. (Lbs. per acre).*

	TREATMENT		RATIO
	Single leaf	Fish leaf	Fish/Single
Flush	3,471	4,042	1.16
Maintenance leaf	3,232	1,016	0.31
Wood	8,642	2,380	0.28
Total growth	15,345	7,438	0.48

The results obtained by fish leaf and single leaf plucking over alternate cycles compared with the continuous single leaf plucking are given in table 15.

Table 15.—*Effect of fish leaf plucking on yield.*

Previous cycle	This cycle	Difference lbs/acre
Fish	Single	— 415
Single	Fish	+ 1,449

It will be seen from the above table that a change over to fish leaf plucking has increased yield very greatly during this last cycle. But the general condition of the bushes has continued to deteriorate with hard plucking.

Cultivation and Weeding Experiment.—Report at the end of the 5th cycle.—The experiment completed its 5th cycle this year. In the previous cycles losses due to the presence of weeds have been recorded (vide Bulletin No. 51, page 36). This cycle has shown an overall gain of 2.5 per cent due to the presence of weeds. This seems to indicate that the lighter pruning, resulting in a bigger spread of the bushes, which was adopted from the fourth cycle onwards has now brought about its full effects in the suppression of weeds. Comparative figures for the last three cycles are given in table 16.

Table 16.—*Percentage gain or less of crop due to weeds.*

Cycle	1st year	2nd year	3rd year	4th year	Cycle
Third	— 16.5	— 14.8	— 9.5	— 1.2	— 8.7
Fourth	— 9.0	— 4.5	+ 0.5	+ 1.5	— 2.4
Fifth	— 2.5	+ 3.1	+ 4.1	+ 3.9	+ 2.5

The effect of intensive cultivation (*i.e.* three times annually) against normal cultivation (*i.e.* once annually) continues to produce a small reduction as in the past, but the difference is negligible as is shown in table 17.

Table 17.—*Dry matter yields in lbs. per acre.*

	1st year	2nd year	3rd year	4th year	Cycle
Normal cultivation	669	1019	988	872	887
Intensive cultivation	666	1002	976	856	875
Difference	3	17	12	16	12
Percentage of mean yield	0.4	1.7	1.2	1.9	1.4

During the previous cycle, no protection being given, the experiment suffered from blister blight attacks with a consequent reduction in yield and nitrogen efficiency (vide Bulletin No. 33). With blister blight protection in the current cycle the general level of yield showed a marked increase which was apparent in the nitrogen efficiency too.

The comparative figures for the past two cycles are shown in tables 18 and 19.

Table 18.—*Dry matter yields in lbs. per acre for 4th cycle.*

Manurial application	1st year	2nd year	3rd year	4th year
Double dose N80, P60, K40	438	872	881	649
Single dose N40, P30, K20	424	814	767	552
Manurial response	12	58	114	97

Table 19.—*Dry matter yields in lbs. per acre for 5th cycle.*

Manurial application	1st year	2nd year	3rd year	4th year
Double dose N80, P60, K40	709	1,132	1,118	973
Single dose N40, P30, K20	626	890	846	755
Manurial response	83	242	272	228

Acknowledgments.—The co-operation of superintendents of estates who have offered clonal cuttings for planting on St. Coombs and at Peradeniya is gratefuly acknowledged. So also is the assistance given by the Superintendent and Assistants on Gonakelle estate, Passara, to the officer-in-charge of the clonal proving station at Passara.

REPORT OF THE PATHOLOGIST FOR THE YEAR 1955

General.—There were no changes in staff. The Mycologist, Mr. B. N. Webster, proceeded on six months vacation leave at the end of September. During his absence the Pathologist supervised the work of the Mycology Department. The Pathologist was on temporary transfer to Mooloya Group, Hewaheta, from 18th April to 15th September for investigations into meadow eelworm. He conducted his normal research programme as well as advisory correspondence and visits to estates from Hewaheta. Thanks are due to Messrs. Colombo Commercial Company and the Manager of Mooloya estate, for their help and co-operation in making the Pathologist's stay as comfortable as possible.

163 letters were received and 213 despatched. 1899 soil samples were examined and reported on for parasitic eelworms. 15 visits were paid to estates for advisory purposes.

Eelworms.—Selection Work.—A large number of healthy looking bushes, growing in tea surrounded by infested plants, was selected for propagation and testing for meadow eelworm resistance. On Mooloya estate a block of infested tea was cleared, drained and terraced in 1954 for a multiplication and test plot. The block was divided into 17 sub plots, 8 of which were planted up in December 1954/January 1955. The rest of the block was sown with *Tephrosia vogelii*.

The early growth of the plants in this block was disappointing. The very clayey soil was heavily trampled by the elephants used in removing the bushes and lost its texture. Waterlogging, therefore, occurred during the southwest monsoon months. Further, the very severe south west winds caused defoliation and set back to plants which were growing well and by the end of August the plants were in an extremely poor condition. A luxuriant growth of *Tephrosia vogelii* was finally established after repeated failures, and there followed a marked improvement in soil drainage and condition. The fairly large pockets, haphazardly distributed through the block, in which water remained stagnant over long periods, were draining fairly well by the end of the year and there was a decided improvement in the growth of the surviving tea clones.

A further 1½ acres, within the protection of a substantial wind-break, and containing better soil, was opened out in No. 20 field on Mooloya. The area was completed in October and planted up with a number of selected clones in December. The whole block will carry over 150 clones, replicated 3 times, in rows containing approximately 15 plants. All Mooloya's better selections and clones selected from many eelworm infested estates together with the best clones from certain other estates will go into this block by the end of 1956. The Mooloya multiplication plot, the cost of which was borne by the Mooloya Tea Company, Ltd., will be the testing and proving ground for the large number of clones which have been selected over the last few years. Mother bushes have been started with permanent number boards.

Three other estates are co-operating in a similar venture and material has been sent to them for propagation.

THATCHING AS A MEANS OF CONTROL OF MEADOW EELWORM.—It was estimated that for adequate thatching of tea fields at least 10 per cent of the area should be in Guatemala grass. Strip planting of 2 rows on the contour, 20 rows apart, while giving this 10 per cent of land in grass, would also allow the rehabilitation of the land for replanting on the contour over a period of 27-30 years. Each contour strip would remain in Guatemala grass for 3 years, after which the grass would be killed and tea planted. The 10 acre block of tea on Mooloya, which was treated in this manner in November 1954, was pruned in October 1955. The contour strips had grown well but extensive supplying of vacancies etc. was necessary and this was done in November, December. It is estimated that sufficient loppings will eventually be available to thatch the 10 acre block 2 or 3 times a year.

Estates, or fields on estates, badly infested with meadow eelworm carry a large number of vacancies and passenger bushes. The removal of the latter will have no effect on the field yield. A count at Mooloya of such vacant and available space for growing material for thatch showed that 40 to 50 per cent of the land was out of production and in the course of erosion following exposure of the soil to the elements. A fairly badly infested field (No. 27) was pruned in June leaving the obviously sick bushes unpruned. All vacancies and land along drains and footpaths were planted with Guatemala grass cuttings in June and resupplied in November/December, at the end of the resting period when the field was brought into plucking. The bushes which have made no growth since pruning will be collar pruned and Guatemala grass established round them. The bushes will not be removed in order to avoid disturbing the soil and causing more erosion. The Guatemala grass will be lopped as frequently as necessary to avoid overhanging and crowding of the tea. It is estimated in this field that at least 40 per cent of the area will carry Guatemala grass. Erosion is severe. It is unlikely that there will be any crop reduction.

ST. COOMBS POT EXPERIMENT.—700 pots to test 70 selected clones were put out in 1955 and will be completed early in 1956. Inoculation at a required level will be necessary in about June 1956. This method will help to short-cut eelworm resistance studies.

ST. COOMBS EELWORM MULTIPLICATION PLOT.—This was extended but is still too small to take the many outside selections. The plot supplied a large number of cuttings to other eelworm infested estates.

FUMIGATION.—(*a*) *Mature tea.* Applications to mature tea of ethylene dibromide, ethylene chlorobromide, 'Nemagon', (a Shell U.S.A. product), and 'Shell D.D.' did not stimulate growth when applied at 30 gallons of 10 per cent dilution in the case of the first two, 2, 5, 10 and 20 gallons per acre in the case of Nemagon, and 40 gallons per acre in the case of Shell D.D. Ethylene dibromide, ethylene chlorobromide and Shell D.D. caused symptoms of toxicity, but Nemagon gave no toxic indications.

(*b*) *Nursery plants in beds.* Shell D.D. at 30 and 45 gallons per acre caused almost total extermination of young tea plants. Ethylene chlorobromide and ethylene dibromide applied at 30 gallons of a 10 per cent dilution in kerosene oil caused high toxicity and many deaths. Nemagon on the other hand did not cause toxicity but showed very definite growth stimulation at $2\frac{1}{2}$ and 5 gallons per acre. Nemagon is up to now the only fumigant tried which can be applied to young tea in nurseries without causing a set back to the plants.

C. A. LOOS,
Pathologist.

REPORT OF THE MYCOLOGIST FOR THE YEAR 1955

General.—There were no changes in the permanent staff of the department; Mr. K. C. T. Perera was employed on a temporary basis for assistance in the blister blight experiments from May 26th. Messrs P. O. Park and E. A. Jennings, of the staff of Messrs Fisons Pest Control, were seconded for work on the joint experimental programme on blister blight control.

The Mycologist proceeded on overseas leave on 1st October, his duties being taken over by the Pathologist in addition to his own.

During the year 665 letters were received, and 562 advisory letters despatched. 339 consignments of diseased material were received for examination and report. 16 estate visits were made by the Mycologist, and 4 by the Technical Assistant. Addresses were given to two District Planters' Associations. Tea Research Institute Pamphlet No. 2, "A Guide to the Protection of Ceylon Tea from Blister Blight", was published.

Blister Blight.—A very prolonged south west monsoon was experienced in 1955, rain starting on May 9th and continuing into November. Periods of sunshine of a week to ten days were however experienced in each of the months July to October, and had some effect in reducing the severity of attacks, which were at their worst in June and early July.

Severe attacks on seed bearers were experienced, particularly in the Dickoya district, where an estimate was made of loss of flowers, amounting to 90 per cent, through blister attack on the young flower stalks and buds. Protection was recommended with an approved copper dust, applied with an efficient power duster.

As a result of an offer made by Messrs Fisons Pest Control Ltd. to provide staff to assist in field experiments on new fungicide formulations a considerable programme of field experiments was made possible, and the assistance provided is gratefully acknowledged. A method of assessment, utilising a numerical basis, was adopted, and results subjected to analysis. Full reports are to be published in the "*Tea Quarterly*" and this report will only deal briefly with the objects and conclusions of each experiment.

(1) St. Coombs No. 8 field experiments.—The long term loss of crop experiment in No. 8 field gave results as tabulated in table 1. It will be seen that the unprotected area, despite a slight adjustment mentioned below, yielded over 1,000 lb. of made tea per acre, although unsprayed since 1946. As pointed out previously, the whole of the experimental area is manured at the rate of the highest yielding plot, and the indication is that heavily manured bushes may be better able to withstand blister blight attacks. This trial will be terminated in 1956, when the area becomes due for pruning, only the unsprayed area being retained.

Table 1.—*No. 8 field loss of crop experiment. Yield records*, 1955.

Block	Treatment	Yield, lbs/acre	Increase over control lbs/acre
A	Control, unsprayed	1,030	—
B	Sprayed both seasons	1,468	438
C	Sprayed S.W. monsoon only	1,377	347

A small scale assay of fungicides was attempted in part of the unsprayed area of No. 8 field, this area being chosen to ensure adequate potential infection. The object of the assay trial was to find whether reduction in plot size could feasibly be undertaken, in order to enable fungicide trials to be carried out on a smaller area than that used at present in field trials. Analysis of the results, and experience during the season, showed that the plot size of four bushes was inadequate, and the site an unfortunate choice, as repeated attacks of blister blight had weakened many bushes to the point of producing little or no flush. A plot size of a maximum of 60 bushes would appear to be adequate for the future. Results will be published in the "*Tea Quarterly*" Vol. XXVII, Parts I and II, March/June, 1956.

(2) No. 6 FIELD EXPERIMENT.—The object of this experiment was to compare the efficiency of commercially available copper oxide and copper oxychloride fungicides and to assess the efficiency of two new fungicide formulations. Results indicated that, under the conditions of the experiment, 50 per cent copper oxide and copper oxychloride formulations were equally effective in the control of blister blight. Neither of the new formulations tested gave control equal to that of the standard copper formulations. Results will be published in the "*Tea Quarterly*" Vol. XXVII, Parts I and II, March/June, 1956.

(3) No. 2 FIELD DUSTING EXPERIMENT.—This experiment was designed to test 4 per cent copper blended dusts using locally produced fillers, to compare the efficiency of commercially available blended and coated dusts, and to ascertain whether a reduction in the copper content of a blended dust could be achieved without loss of efficiency, by using coated dust, instead of a pure copper compound, as the basis for blending.

The data gained from this experiment indicated that all treatments gave satisfactory control of blister blight. Details of the slight differences recorded will be published in the "*Tea Quarterly*" Vol. XXVII, Parts I and II, March/June, 1956.

(4) MATTAKELLE No. 7 FIELD EXPERIMENT.—The full report of this field experiment will be published at a later date, but it should be placed on record that, under the conditions of this experiment, spraying with a 50 per cent copper fungicide at 8 daily intervals and dusting with a 4 per cent copper coated dust at 6 and 8 daily intervals were almost equally effective.

(5) FIELD SCALE TRIAL OF 'FYTOLAN'.—Fytolan is a copper oxychloride fungicide (50 per cent copper), produced by Messrs. Imperial Chemical Industries Ltd. It was tested on a field scale on St. Coombs Estate, during the south west monsoon. Assessments of blister blight incidence indicated

that it effected control equivalent to that of "Perenox," and it is accordingly included in our list of approval fungicides.

(6) North East Monsoon trials.—The north east monsoon of 1955 to 1956 was an almost complete failure, and although many of the experimental products reported on above were tested on an estate scale during this monsoon, conditions on most of the estates concerned were such that little or no useful information could be gained. Routine fungicide testing was however carried out and the results included in this report are of trials which were virtually completed before the end of the year. The reports to follow refer to the performance of the products named under the relatively light monsoon conditions prevailing. Perenox, Blitox and Shell Copper were included as standards.

'*Coppesan*'.—This is a copper oxychloride fungicide produced by Messrs Boots Pure Drug Co. Its physical performance compares very favourably with other proprietary 50 per cent copper fungicides and preliminary field tests indicate that it gives a degree of protection equivalent to standard products in general use.

'*Shell Copper Naphthenate*'.—This emulsion was used at the rate of ½ and 1 pint per acre in 12 gallons of water. The copper naphthenate emulsible concentrate did not at first emulsify correctly when added to water, but formed large clots which clogged the nozzles. Addition of 'Shell Emulsifier L' at 8 per cent to the emulsible concentrate gave an excellent emulsion. Control of the disease was not as efficient as with Perenox, Blitox and Shell Copper.

'*Cobredon*'.—This is a copper carbonate fungicide containing 45 per cent metallic copper. Applied at 6 ounces per acre it gave control as effective as Perenox, Blitox and Shell Copper sprays. The product is distributed by Messrs Millers Ltd.

Shell Copper with '*Tenac*' *Sticker.*—Shell copper fungicide at 4 ounces per acre with 2 ounces Tenac sticker gave control of blister blight of the same order as Perenox and Blitox spray applied at 6 ounces per acre.

'*Bayer* 4521 *Red Copper*'.—Trials with this fungicide were carried out on Gonakelle Estate, Passara. A 20 acre field pruned in January 1955 was selected for the trials. The field was divided into two halves, one half being sprayed with compound 4521 at 6 ounces per acre at 8 day intervals and the other half with Perenox at the same application rate and interval. The estate authorities report that the north east monsoon being almost a failure, the trials could not be said to be conducted under normal conditions when blister blight is very severe. Observations were made at fixed observation points on 17 occasions during the experiment. In the area treated with compound 4521 four of the six observation points had blisters practically throughout the experiment period, though at no time was infection considered heavy. In the Perenox treated area only one blister was observed on one occasion throughout the experiment. The difference in infection level, even though weather conditions were not conducive to blister blight attacks, was sufficiently marked to show that that compound 4521 gave inferior control to that of Perenox. We do not recommend the use of Bayers Red Copper Compound 4521 in its present formulation.

'*Bayers Compound* 4663' (*5 per cent copper dust*).—This was compared with "Blidust" 4 per cent dust on Hope Estate, Hewaheta. There was no difference in the degree of control but in this experiment also an unusually light monsoon made the trials of little value.

SPRAYING AND DUSTING EQUIPMENT.—Two power dusters, a hand duster, and a knapsack battery were tested and reported on during the year.

"BSE Junior" power duster.—This machine was used in the dusting trials on Hope estate, Hewaheta. Considerable trouble was experienced with the machine. Early in the trial there was a partial seizure of the agitator spindle, probably caused by the dust entering the sleeve in which the spindle revolves. Corrosion was considerable on the fan casing and on the fan blades. Finally it was reported that the fan covering and the hose were so badly corroded that dust was sucked into the cooling fan to lodge in the flywheel, causing stoppages of the engine. The machine was considered unsuitable for dusting tea fields.

The 'Kestrel' power duster.—This machine was used on an estate scale, during the complete south west monsoon, through the kindness of Mr. A. C. Murray of Gallebodde Estate, Watawala, and the Agents, Messrs. Mackwoods Ltd. Although designed for carriage by two labourers, a simple feat on easy terrain, large scale dusting of tea was considered impracticable with this machine. The design and performance of the machine were considered to be eminently satisfactory for dusting of tea seed bearers, shade trees etc. and it should prove extremely satisfactory in rubber.

The 'Kestrel' hand duster.—A suggestion that the operating handle of this machine should be raised was adopted. This resulted in more convenient operation in tea which had grown into the 3rd and 4th year from pruning.

The modified machine was approved for use in the control of blister blight disease. Even before modification it gave an excellent performance throughout the season in the dusting trials on St. Coombs.

Platz 'Express' battery sprayer.—This outfit was examined and reported on as entirely suited for blister blight spraying. The charge pump and the sprayer, together with the very efficient pressure regulation valve, are well made and thoroughly to be recommended.

Wood-rot.—A field scale experiment on the incidence of wood-rot under low country conditions was laid out on Korahilagoda Estate, in the Galle district during July. A new clearing which had not previously been pruned was essential for the experiment, as pruning cuts have been regarded popularly as one of the principal means of ingress of wood-rotting organisms. The 'traditional' points of entry of wood-rot are, as stated, pruning cuts, and the upper surfaces of branches which have suffered sun-scorch at pruning time. Treatments were therefore aimed at preventing entry at these two points, and consisted of protection of pruning cuts, and shading of the plants until a canopy had been re-established.

These two treatments were superimposed, and with a control totalled four treatments, with four replications. Plots of 100 bushes were chosen, and each of the 1600 bushes was examined individually for wood-rot already present at the commencement of the experiment.

As a result of examination, over 70 per cent of the bushes were found to have wood-rot already well developed in the centre of their frames. Closer examination proved this to have originated, in almost every case, from infection of the centering cut. The practice of centering into wood of pencil thickness or even less, cannot be too strongly condemned under low-country conditions, and every attempt should be made to achieve the necessary spread by thumb-nail pruning of soft tissues.

Three-monthly visits were paid to the experiment, new sites of wood-rot individually recorded and tissues removed for laboratory examination. 200 isolations of fungi present in the tissues have been made to date, and twelve different species recognised.

The experiment is to be repeated under mid and up-country conditions.

Hail Damage.—Some observations on hail damage were made from May to August, on Nayabedde Estate, Bandarawela, which experienced a severe hailstorm in July 1954. The degree of recovery on areas treated immediately with an excess lime Bordeaux mixture was considerably higher than on untreated areas. Results were published in the "*Tea Quarterly*" Vol. XXVI, Part III, September 1955, pages 108-110.

Root Flora Examination.—This work was continued, mainly in the U.K. during the Mycologist's furlough, and some interesting results are indicated. From 400 isolations made of fungi firmly attached to feeding root surfaces, over 300 were found to belong to potentially pathogenic species, *i.e.* species which have been shown previously to be pathogenic to tea or other crops. The investigation is to continue with emphasis on the effect of different cultural practices on the root fungus flora.

B. N. WEBSTER,
Mycologist.

REPORT OF THE ENTOMOLOGIST FOR THE YEAR 1955

General.—The Entomological department was restored as an independent unit with the Entomologist in charge after a lapse of about 8 years. The Assistant Pathologist at Passara reverted to his previous position as Assistant Entomologist, functioning with headquarters at Ratnapura from June 1955. Two assistants in the junior grade were appointed to the permanent staff in July 1955. A special research Entomologist, Dr. E. Judenko, of Messrs Fison's Pest Control Ltd., was appointed to work on the shot-hole borer pest in the Ratnapura district and he assumed duties at Millawitiya in September.

44 visits were made to estates during the year to advise superintendents regarding the control of pest outbreaks. 227 specimens of pests were received for identification and report. A number of advisory circulars were prepared on the more common pests as a preliminary step in the preparation of a bulletin on insect pests associated with tea cultivation in Ceylon.

Amongst important pests which caused economic loss were scarlet mite, (*Brevipalpus phoenicis* and *Brevipalpus australis*), in the Dimbula, Dickoya and Maskeliya districts; red spider, (*Oligonychus coffeae*), in Uva and in the mid-country areas of the Central Province, and yellow mite, (*Hemitarsonemus translucens*), in practically every district. Severe shot-hole borer damage was reported from the Ratnapura and Kegalla districts.

Among the pests of less importance on tea were nettle grub, (*Natada nararia*), Lygus bug, (*Lygus viridanus*), purple mite, (*Calacanus carinatus*), army worm, (*Prodenia litura*), white grubs, (*Anomala sp.*), in new clearings and nurseries, red borer, (*Zeuzera coffeae*), and termites.

With regard to shade tree plants, *Grevillea robusta* and *Albizzia moluccana* were severely attacked by scarlet mite in the Dickoya district; Albizzia was affected by a severe attack of bagworms, (*Acanthopsyche subteralbata*), which occurred at Dehiowita, and bark borer, (*Indarbela quadrinotata*), at Ingiriya. Several reports of attack by Albizzia butterfly, (*Terias silhetana*), were also received.

Mites.—(1) Scarlet Mite.—Much work was carried out in connection with the control of scarlet mite by the use of acaricides. The conclusions reached were as follows:—

(i) The mite can be effectively controlled in the field by the application of the acaricides sulphur, chlorobenzilate, ('Akar'), 'Karathane' and 'F.W.293'. They are approximately equally effective but sulphur and F.W.293 can cause tainting, the former up to 3 weeks after application and the latter up to 10 days after application. In the case of chlorobenzilate and Karathane no tainting is discernible 1 week after application.

(ii) Several applications, 3-4 or more of a heavy 100 gallon per acre spray, are required for effective control owing to the relatively inaccessible position of the mites on the under surfaces of the mature leaves.

(iii) Application of acaricides in the manner normally carried out for blister blight control was found to be ineffective for the control of the scarlet mite.

(iv) Proper management and control of Grevillea and Albizzia shade and temporary resting of badly attacked tea are necessary subsidiary measures for arresting damage and controlling the pest.

(v) Synchronising the control measures with the pruning of the tea and lopping of shade is important in connection with routine and economic control.

Trials were also laid down at St. Coombs to observe the long term effect of acaricide application on the loss of crop experienced, but the degree of infestation was too low to show significant differences in yield between treated and control plots.

(2) Yellow Mite.—The following acaricides were tested against this mite and found to be relatively ineffective: chlorobenzilate, (Akar), Karathane, F.W.293 and 'Basudin'.

Shot-hole Borer.—Much of the experimental work with regard to the control of this pest was directed towards ascertaining an effective insecticidal application, and the practicability of the use of such an application in connection with the maintenance of economic control and the danger of upsetting the biological equilibrium. The work carried out during the year made the following conclusions possible:—

(i) Dieldrin is an effective insecticide for the destruction of this insect and is best applied in 2-3 applications at a strength of 0.1 per cent active ingredient immediately following and preferably within 2-3 weeks of pruning. (*WARNING:—The use of insecticidal applications for shot-hole borer control is NOT at present recommended by the Institute—Director.*)

(ii) Applications done at later periods after pruning are less effective in destroying borer owing to coverage of stems by developing foliage. Late applications also carry strong potential risk of giving rise to tortrix caterpillar outbreak, as a result of the residual effect of the insecticide on the parasite population in the area. Such outbreaks have then to be controlled by the application of a special insecticide on the foliage.

(iii) In the case of young tea insecticidal applications for shot-hole borer control may have to be accompanied by special applications for subsequent tortrix caterpillar control.

(iv) There are indications to show that borer populations, if so reduced by spraying at pruning time, may be unable to build up to economically important numbers subsequently in the cycle.

B. A. BAPTIST,
Entomologist.

REPORT OF THE SCIENTIFIC OFFICER, LOW-COUNTRY SUB-STATION, FOR THE YEAR 1955

General.—The T.R.I. activities in the low-country were considerably expanded during the year, and the staff permanently stationed in the low-country was greatly increased. These staff increases consisted of one "independent unit" and three assistants working on extensions under the control of departmental officers of the Tea Research Institute; there were no staff changes at this station and its organisation remained unchanged.

The staff stationed in the low-country at the end of the year consisted of 3 senior officers and 3 assistants as follows:—

Mr. T. E. Walter, Scientific Officer, stationed at Pembroke.

Dr. E. Judenko, Entomologist, Special Research
Mr. G. D. Austin, Assistant Entomologist
Mr. C. Shanmugam, Assistant
} Stationed in the Ratnapura district, working on shot-hole borer.

Mr. F. P. Jayawardene, Assistant (attached to Scientific Officer.)

Mr. D. D. Kroon (attached to Agricultural Chemist, stationed at Endane Estate, Kahawatta).

326 letters were received at this station and 347 letters were despatched.

28 advisory visits were made to estates.

7 Planters' Association meetings were attended during the year. Addresses were given at the Biennial Conference of the Tea Research Institute and at a meeting of the Morawak Korale Planters' Association, both of which were published in the *Tea Quarterly*.

Our thanks are again due to the management of Vogan, Ingiriya and Galbodde estates for continuing to allow us facilities for field experiments on these estates. Similarly to the management of Endane, Mahawale, Millawitiya and Korahilagoda estates for extending us new facilities.

Our thanks are also due to the Directors of the Neuchatel Estates Ltd., who during the year agreed to lease 25 acres of land on Neuchatel to the Institute for the establishment of a clonal proving station.

Field Experiments.—The experiments in connection with shot-hole borer were considerably extended and new experiments, on the manuring of high yielding tea and on wood rot, were laid down; for further details of these experiments, reference should be made to the reports of the specialist officers concerned.

The routine upkeep of the other low-country field experiments continued under my supervision.

Vegetative Propagation Experiments, Vogan Estate.—The planting of the 4 acre block leased to the Tea Research Institute was completed during the year; there remained a large number of plants in the nursery, surplus to our immediate requirements, amounting at the end of the year to some 10,000 plants (in various stages).

The collection of cuttings from outstanding low-country estate clones was continued; preliminary reports on some of these indicated that they are probably in the 3,000 pounds per acre class. In the collection were some which are almost completely resistant to yellow mite attack, and one with remarkable powers of callussing, (giving it a high degree of resistance to shot-hole borer damage).

A comprehensive collection of cuttings of the most promising T.R.I. clones was also received; most of these showed by the end of the year approximately 70 per cent success. Judging by reports received from some other estates, however, it must be emphasised that this degree of success can only be achieved if the cuttings are put in during spells of rainy weather; additional care with regard to the correct shading of the cuttings (with coir matting) will also be well repaid.

By the end of the year the 1951 series clones had been in plucking for ten months and the following table gives the calculated yields of the most promising clones of this series, for the first full year:—

Table 1.—*Yields of some clones from Vogan plots to end December* 1955 (10 *months in plucking*).

Estate	Clone No.	Number of plants	Calculated yield lbs./acre first full year at 5,000 plants per acre
Alupolla	3	21	1,485
	13	17	2,062
	17	35	2,270
	19	32	1,740
Ederapolla	24	54	1,740
	54	11	1,897
	97	27	1,400
	184	38	1,650
	350	31	1,400
	397	22	1,570
Opata	66	47	1,400
	117	15	1,570
	379	70	1,485
Panawatte	6	34	1,320
	13	12	2,650
	20	6	2,650
	33	11	1,570
	34	23	1,740
	40	18	2,062
	44	24	1,570
	48	11	1,897
	69	16	2,392
Rayigam	20	16	1,485

In addition to the clones there are at Vogan 390 bushes raised from seed. These bushes have been in plucking 7 months and their calculated yield for the first year on the same basis is 700 lbs. per acre. It will be seen, therefore, that the figures for these clones compare extremely favourably with those so far obtained from the bushes raised from seed—although of course the two are not strictly comparable as the bushes raised from seed have been in plucking for a shorter time.

Pruning Cycle Cum Shot-Hole Borer Control Experiment.—(Ingiriya Estate). During the year this experiment was modified since observations made during the previous year made it fairly obvious that the die-back and loss of crop referred to previously were attributable almost entirely to shot-hole borer (and not "Rhizoctonia"). In practice this meant that half the 18 months and 3 year cycle plots, which were pruned in June, received shot-hole borer control measures, consisting of 2 sprayings with 'Dieldrex' shortly after pruning. There was of course no significant difference in yields by the end of the year.

The experiment had run 3½ years as at 31st December and at that date the total yield to date in pounds per acre of the various plots was as follows:—

18 months cycle plots	3,847 lbs.	Yield graphs rising steeply, approximately parallel.
3 year cycle plots	3,425 lbs.	
2 year cycle plots	3,327 lbs.	Yield graphs rising less steeply, approximately parallel.
2½ year cycle plots	3,212 lbs.	

Although no final conclusions can be drawn from this data, and "intermediate" comparisons at any given stage are not strictly valid, it is obvious that the lead so far gained by the 18 months cycle plots is of great significance and fully supports the observations (and preliminary data) previously published on my own responsibility.

Miscellaneous Observations.—Pests in the low-country appeared to be more active during the year than usual. There were widespread attacks of yellow mite and red spider during periods of drought—particularly in the Ratnapura and Morawak Korale districts; attacks of nettle grubs and bag-worms caused some concern on two estates, and the usual minor attack of Helopeltis occurred in the Rakwana district. Albizzias, especially in the new clearings, also suffered some damage from bark borer, as well as die-back and defoliation (of unidentified origin).

The attacks of yellow mite and red spider (to which reference has already been made) reached quite serious proportions in some districts during the dry weather; however, they cleared up almost completely during the monsoons. The superintendent of one estate reported that (on our advice) he had resorted to spraying with 'Akar' as a means of controlling red spider and that several rounds of this treatment had been completely successful.

Observations were continued on shot-hole borer with special reference to shortened cycle lengths. Information is of course lacking on the long term effect on yield of a shortened (18 months) cycle, but all the evidence collected from estates which have recently adopted an 18 month cycle supports the experimental evidence previously referred to. The only "dissensions" on this subject come from estates which had tried an 18 months cycle many years ago, where it was combined with the very low pruning that was then in vogue (12" and even less!). Of the various factors which are of significance in this problem, the type of pruning carried out is perhaps one of the most important.

In general, observations show that a light cut-across is best suited to a shortened cycle; if a rim-lung prune is adopted, it can only be successful if the pruning height is not less than 18". On the basis of the information so far available it is not feasible to make any general recommendations on this question—*i.e.* a recommendation applicable to all low-country estates—and every case has to be considered individually. Noteworthy increases in yield have, however, often resulted from the adoption of an 18 months cycle—one estate reporting an increase in overall yield from 750 pounds per acre to 1,020 pounds per acre as a result of combining a shortened cycle with a lighter type of prune (and resting where necessary).

It is also of interest to record that a cycle length as short as 13 months has been tried on a 1948/49 new clearing where symptoms of shot-hole borer attack appeared somewhat earlier than usual. Current indications are that this cycle length appears to be perfectly feasible in new clearings under the conditions referred to—provided of course that the prune is a light cut-across. The yields of this field for the first 10 months in plucking (second cycle) were 792 pounds per acre compared to 665 pounds per acre for the corresponding period in the first cycle.

Further observations on "leaf-fall disease" were made, and yield records from a severely affected field on an estate in the Ratnapura district were received regularly. The pruning cycle of this field was extended to 32 months and the following data summarises the information obtained from it with regard to yields:—

Total yield for previous cycle (24 months) 1,816 lbs. per acre.

„ „ „ present „ (24 months only) 2,481 lbs. per acre.

„ „ „ „ „ (32 months) 3,275 lbs. per acre.

From these figures it will be seen that—in spite of the severe defoliation of the maintenance leaves—the average yield for months 25-32 amounted to 99 pounds per acre, compared with 103 pounds per acre per month for the first 24 months of the cycle, and 102 pounds per acre per month for the whole 32 months cycle.

These figures do not lend any support to the view commonly held that the "leaf-fall disease" under review in itself precludes the extension of pruning cycles in the low-country. The considerable increase in yield during the current cycle (in which the leaf-fall was particularly severe) as compared with the previous cycle is also of interest.

Examination of large numbers of the maintenance leaves involved in this leaf-fall disease indicate that white thread blight is the commonest pathogen found; however, there is no one fungus found universally on all the dead or dying leaves, and in fact many of the leaves in this condition apparently have no fungus at all. It is obvious, therefore, that this problem is not entirely a mycological one; physiological factors (particularly drought) are also likely to be involved to some extent.

A large number of specimens of young albizzias showing die-back and defoliation were examined, most of those which had at some time been lopped had cankers which produced a ring-barking effect, leading to die-back. On the other hand many young trees were found which had never been lopped, yet showed quite severe defoliation of the young shoots; the only organisms invariably found on these shoots were black ants.

Chlorosis symptoms, sufficiently severe to necessitate resting, with consequent loss of crop, were observed on a 1950 clearing after the second tipping (second cycle). This field had been rested for nearly 2 months following a severe attack of shot-hole borer which occurred in the 14th month. It was then pruned at 18"—without taking the normal precaution of leaving rim lungs.

In view of the fact that these symptoms have not previously been noticed on fields which have been given a similar clean prune, it seems likely that shot-hole borer was a contributory factor to the chlorosis. This example serves to illustrate the importance of adopting recognised pruning methods in fields affected by shot-hole borer—more especially where a shortened cycle is being adopted.

T. E. WALTER,
Scientific Officer, Low-country Sub-Station.

REPORT OF THE MAINTENANCE ENGINEER FOR THE YEAR 1955

General.—Towards the end of 1954 the Board sanctioned a sum of Rs. 170,000 for repairs and decoration of staff houses and also approved a large programme of road improvement. Plans were also made for increasing the water supply, which has for long been inadequate at St. Coombs during periods of drought.

To carry out the above work it was necessary in 1955 to increase the staff of the department and to purchase several items of heavy machinery. A temporary storekeeper-typist was taken on at the Engineering Department office; a sub-overseer was recruited, and drivers employed for the newly purchased stone-crusher and 6 ton road roller.

The maintenance and repair of all vehicles, machinery and equipment was again carried out at the workshop and motor garage, which between them satisfactorily executed 976 jobs.

During the year the department assumed responsibility for the daily collection and disposal of refuse from staff bungalows and the laboratory; an Austin tipping truck, purchased during the year, was used to collect the refuse, and a large incinerator was built for burning the rubbish.

An effort was made during 1955 to improve the general appearance of the grounds and the department was responsible with the Superintendent for tidying up unsightly areas around the various buildings.

Buildings and Fixed Plant.—(1) Quarters.—All staff quarters, including Pembroke bungalow, were painted externally with snowcem. The fittings and equipment in kitchens and bathrooms, which were often in a state of disrepair and had been condemned by the Board of Survey in 1954, were replaced as necessary in all senior staff houses and in 12 junior staff houses.

Two new septic tanks were built, and some unserviceable sewerage lines were replaced.

A building was constructed to accommodate 30 labourers, required for the maintenance programme. This building was provided with piped water and two water seal latrines.

(2) Factory.—The ground floor walls, including all fire protection equipment, were painted in accordance with an I.C.I. colour scheme.

(3) Laboratories.—The Chemistry Department was redecorated. A three phase A.C. switchboard was installed in this department, and rewiring carried out.

(4) Maintenance Engineer's Office.—An extension was built to the workshop to provide an office for the Maintenance Engineer.

(5) Vehicle shelter.—A covered shelter was built for the Institute's vehicles, which previously were parked outside the factory in the open. An end bay of this shelter was bricked up to make a store room.

(6) Petrol and oil store.—Structural alterations were made to the old co-operative cadday, in order that it should conform to the Government regulations for storing of petrol and oil.

(7) Sports Club.—A tennis court was laid outside the Norris Memorial Building, and has proved a popular amenity. An area below the tennis court has been cleared and levelled to provide a practice pitch for cricket and a childrens' playground.

Machinery and Equipment.—(1) Winget stone-crusher.—This machine was bought in February, and, in spite of a few breakdowns, produced 1,000 cubes of graded metal in 1955, which was used for metalling roads and in the construction of bridges and culverts. During the next few years there is likely to be a considerable building programme, and this machine should prove very useful.

(2) Road rollers.—A 6-ton Buffaloe Springfield road roller was bought and has done an excellent job in consolidating the newly remetalled roads. A Stothert and Pitts 5 cwt. vibrating roller, though not satisfactory for long stretches of metalled roads, was particularly suitable and useful for construction of the tennis court, for the consolidation of gravel roads and for repairing holes in metalled roads.

(3) Factory equipment.—All factory machinery was maintained in good order. A conveyor to take rolled leaf to the roll-breaker was in the course of construction at the end of the year.

(4) Experimental machinery.—A battery of four miniature rollers, mounted on a steel table, and driven by a 2 h.p. motor, was completed after considerable delays due to the late arrival of certain vital parts from the U.K.

(5) Machinery and equipment for exhibition purposes.—Three cabinets for showing colour transparencies were made. Also an electrically driven, intermittently rotating, drum, for continuous display of sets of colour transparencies.

A model of a contour clearing and a miniature tea sifter were also made.

Roads and Bridges.—One mile of the main access road was widened, dangerous corners eased out, and the surface remetalled. The roads to the guest house and club and $\frac{1}{4}$ mile of the main estate road were also metalled. The bridge at the foot of the entrance road to the factory was widened to 16 feet, and 14 culverts on the main road widened to conform to the newly reconstructed road.

Water Supply.—The normal maintenance of the filtration plant, mains and domestic appliances was carried out. At Pembroke bungalow, the well was deepened, more tanks provided, and an adequate supply of water ensured.

Plans proceeded to augment the water supply at St. Coombs. Mr. Gore, engineer of the Paterson Engineering Company, India,visited St. Coombs in June and made general recommendations for the storage of a much greater quantity of water, and for its treatment and equitable distribution. His recommendations were accepted, and the Board appointed Mr. Gibbs of Binnie, Deacon and Gourlay as Consulting Engineer for the scheme.

On behalf of Mr. Gibbs a contour survey of the catchment area was carried out, and various other preliminary data were calculated and sent to Mr. Gibbs.

Crop Protection.—Several types of sprayers and dusters were repaired and tested.

D. V. W. PERERA,
Maintenance Engineer.

REPORT OF THE OFFICER-IN-CHARGE SMALL HOLDINGS ADVISORY SERVICE FOR THE YEAR 1955

General.—There were no additions to the staff during the year. The demands on the service continued to increase, especially in connection with the work of the recently established co-operative societies with whose officers the service maintained the closest liaison.

Advisory.—The volume of correspondence and the number of visits made to individual small holdings are shown below for the last three years, and indicate how the service has expanded.

	1953	1954	1955
Letters received	7,483	8,940	11,362
Letters despatched	10,277	11,438	15,511
Visits made	9,428	11,126	15,377

Propaganda.—(1) Demonstration Plots.—There are now over 200 demonstration plots in the different provinces maintained entirely by keen small holders, who have been encouraged by the free issue of manure and tea seed. These plots have been invaluable in demonstrating proper methods of management to the many smallholders who visit them.

(2) Loans.—Loans to smallholders to purchase manure have been stopped since they can now obtain their requirements through their co-operative societies. The service continued to provide facilities for the purchase of tea seed. 157¼ maunds were bought during the year.

(3) Field days and Exhibitions.—Several field days were held during the year, and the service also took part in three agricultural exhibitions where various aspects of planting were demonstrated.

(4) Publications.—A propaganda leaflet was published on the tea co-operative societies to enable the smallholders to assess the benefits they would derive by joining one of these societies.

A book in Sinhalese on tea planting was published. This is the first of its kind, and should fill a long felt need.

(5) Audio-Visual Aids.—The Government is producing a film on tea for general distribution. The Government Film Unit was assisted to locate suitable sites for "shooting".

Under the Colombo Plan Technical Aid programme ten projectors were received by the service from the Australian Government, which also sent an expert to advise on the use of audio-visual aids. During his stay in Ceylon Mr. Middleditch trained an officer to carry on this type of work.

The U.K. and U.S. Embassies and the Government Information Department again loaned films of educational value. During the year the following shows have been given:—

Central Province	...	41
Sabaragamuwa	...	4
Southern Province	...	9
		54

Co-operative Societies.—During the year the number of societies increased from nine to twenty with a membership of 3,628 covering an area of 14,775 acres. This scheme has now been in existence for two years and some progress has been made. One society has already built its own tea factory and another society has started collection and manufacture, the manufacture being made possible through the very kind courtesy of the local manager of Messrs. The English and Scottish Joint Co-operative Wholesale Society, Ltd.

The ultimate aim of each society is to have its own manufacturing centre, thus eliminating the middleman and bought leaf factory owner, and ensuring a fair average price to the producer.

Some societies have started the collection of members' green tea leaf, hoping it would provide better bargaining powers and thereby help to obtain a better price for members' green leaf. In practice this has proved a failure and societies have only replaced the middleman and allowed the factory owner to continue to make his large profits.

During the year the Hon. Mr. J. R. Jayawardena, Minister of Agriculture, spent a few days in the Southern Province (Galle-Deniyaya) visiting those small holdings receiving assistance through this Government Co-operative Scheme.

Study Visits.—The following gentlemen visited us during the year and they were shown the work that this department was engaged in:—

Mr. Samaranayake from Department of Commerce.

Mr. Tarr from Tanganyika.

Mr. Rodrigoes from the Philippines.

Mr. Farwardin from Persia.

Acknowledgments.—The continued help and co-operation received from the Embassies of the United Kingdom and United States and from the Government Information Department, in connection with the supply of films, is gratefully acknowledged.

R. L. ILLANKOON,
Officer-in-Charge.

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The Tea Research Institute of Ceylon

The Smallholdings Advisory Service

Staff at December, 31st 1955

Officer-in-Charge	...	R. L. Illankoon
Tea Smallholdings Officers	...	W. T. Fonseka, K. P. Abeywickrema, M. V. de Silva and K. de A. Kulasekera
Tea Instructors	...	S. Abeywickrema, D. J. Kulatunge, G. A. Mendis, P. T. Navaratne, C. E. Sooriyaaratchchi, D. Nillegoda, K. A. Perera, T. B. Ratnayake, G. A. de Silva, B. Weeratunge, A. M. R. Illawatura, P. H. Jayasinghe, P. B. Kappagoda, R. L. Weerasekara, L. U. Weerasinghe
Office Assistants	...	N. H. Liyanage and A. B. Jayasundara
Cinema Operator	...	L. Vincent

NOTE

The Laboratories of the Institute are situated at St. Coombs Estate, Talawakelle, and letters and enquiries should be addressed to the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle, Telegraphic Address:—Research, Talawakelle, Telephone:—Talawakelle 44 (private exchange). Replies to correspondence addressed other than "The Director" may be subject to some delay. Specimens and other consignments sent by rail should be forwarded to Talawakelle station, C/o Messrs. M. Y. Hemachandra & Co., Ltd., Forwarding Agents. Carriage should be prepaid.

The address of the Low-country Scientific Officer is T.R.I., Pembroke, Bombuwela, near Kalutara, and Low-country estates should address their letters and enquiries directly to this officer.

The address of the Officer-in-Charge of the Smallholdings Advisory Service is 140, Ambagamuwa Road, Gampola.

The Tea Research Institute of Ceylon

Board of Control at December, 31st 1955

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Mr. N. B. Parker
Vacant

Appointed by the Agency Section, P.A. of Ceylon.

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The Director of Agriculture
The Chairman, Planters' Association of Ceylon
The Chairman, Agency Section, Planters' Association of Ceylon
The Chairman, Low-country Products Association
The Tea Controller

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